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ABSTRACT

International High School, New York (New York) is a secondary school for students who have been in the United States less than 4 years and who score below the 20th percentile on an English language proficiency test. The 310 students of 1988 came from 37 nations, and spoke 32 languages. An evaluation conducted in the 1991-92 school year indicates why this school is successful in keeping students, all of whom are considered at-risk in school until graduation. Classroom observation, portfolio committee conferences, interviews with faculty and students, and review of school documents, portfolios, and curricula show that the school is committed to a collaborative, experiential approach that combines reflection and authentic assessment with instruction. Developing English skills while using the native language as a resource for the student and society, using multiple learning contexts, providing career education, and involving teachers in decision making were cornerstones of the school's success. Five exhibits are samples of student work. Two tables present data about the school. (Contains 12 references.) (SLD)

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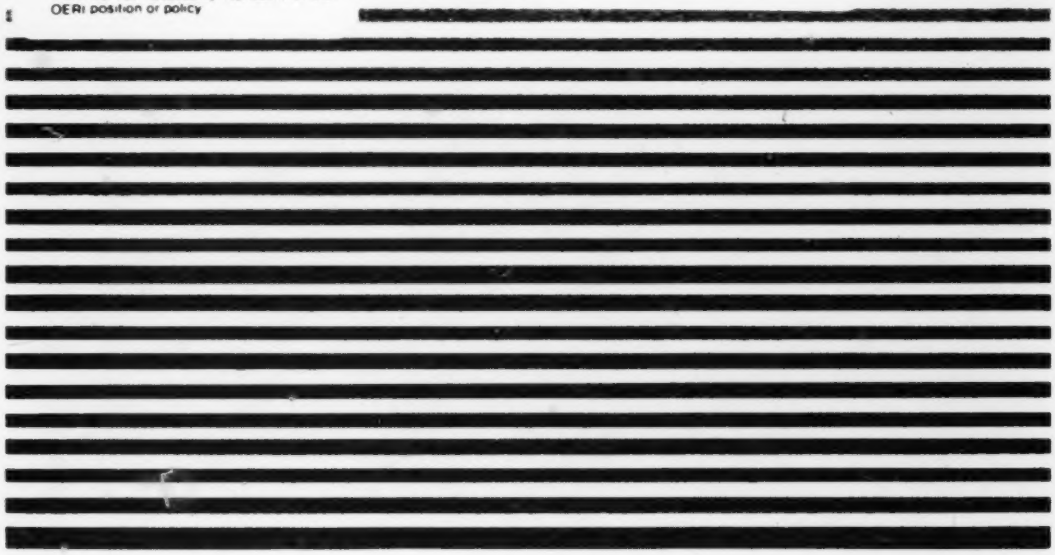

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September 1994

A version of this paper will appear as a chapter in ***Authentic Assessment in Action***,
by Linda Darling-Hammond, Jacqueline Ancess, and Beverly Falk,
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Jacqueline Ancess
Linda Darling-Hammond

In a July 4, 1988, editorial, ***The New York Times*** asked the $64 million school-reform question about a school that, under normal circumstances, many might think doomed to fail:

> International High School is one of the more exclusive secondary schools in New York City. Only students who have been in the United States less than four years and who score below the 20th percentile on an English language proficiency exam are admitted. The 310 students come from 37 nations and speak 32 languages.
>
> ...All students are considered "high risk," likely to drop out. Yet the daily attendance rate is 90 percent, compared with a citywide average of 80 percent. And the dropout rate of the three-year-old school is 3.9 percent, compared with nearly 30 percent citywide. The first senior class is graduating this year; every one of the 54 seniors will start college in the fall.
>
> Why does International succeed where so many city high schools fail? (Sturz, 1988).

The answer to this question lies in International High School's commitment to a collaborative, experiential approach to teaching and learning married to schoolwide processes of reflection and authentic assessment deeply embedded in all the activities of the school. International is committed to viewing teachers and students -- along with community agencies and workplaces -- as resources for each other, using participation in decision making and collective action as the basis for growth and development. The school's policies and classroom practices foster self-assessment and responsibility as the foundations for lifelong learning. These commitments are reflected in the educational principles that underlie the school's approach to instruction:

1. Limited-English-proficient students require the ability to understand, speak, read, and write English with near-native fluency to realize their full potential in an English-speaking society.

2. Fluency in a language other than English must be viewed as a resource for the student, the school, and the society.

3. Language skills are most effectively learned in context and when embedded in a content area.

4. The most successful educational programs are those that emphasize rigorous standards coupled with effective support systems.

5. Attempts to group students homogeneously in an effort to make instruction more manageable preclude the way in which adolescents learn best, that is, from each other.

6. The carefully planned use of multiple learning contexts in addition to the classroom (e.g., learning centers, career internship sites, field trips) facilitates language acquisition and content-area mastery.

7. Career education is a significant motivational factor for adolescent learners.

8. The most effective instruction takes place when teachers actively participate in the school decision-making process, including instructional program design, curriculum development, materials selection, faculty hiring, staff training, and peer evaluation. (International High School at LaGuardia Community College [IHS], n.d. b).

This philosophy was much in evidence in the observations of classrooms and portfolio committee conferences, interviews with faculty and students, and review of school documents, curriculum, and student portfolios we conducted during the 1991-1992 school year.

The School's Students and Successes

Then a seven-year-old collaboration between the New York City Board of Education and the City University of New York, International High School in 1992 served 459 students from 54 countries, who speak 39 languages and represent a wide range of native- and English-language and literacy proficiencies. Students in this citywide magnet school are in grades 9 to 12 and range in age from 14 to 21. Forty-five percent are Latino, 30 percent are Asian, 22 percent are white, and three percent are black. Three-quarters of the students qualify for free or reduced-price lunch.

With this highly diverse student body, International has achieved outcomes that far surpass those accomplished by schools with much more affluent and traditionally advantaged students. It continues to have a graduation rate of over 95 percent, while more than 90 percent of its students are accepted each year at postsecondary schools. As Table 1 indicates, virtually all of the students pass the New York State Regents Competency Tests, an unusual accomplishment for students whose first language is not English and who have been in this country for only a short time. More important, students accomplish much more intellectually challenging tasks than the state tests require as they work through the demanding performances posed in their classroom and internship assessments.

Table 1

International High School Regents Competency Test Results

(Percent passing by year)

	1990	1991	1992
Examination	%	%	%
Reading	95	98	99
Writing	93	100	98
Mathematics	100	100	100
American Studies	89	98	97
Global Studies	--	100	100
Science	--	100	100
Occupational Education	--	--	100

The school's accomplishments have received repeated national recognition. In 1986, the Council for Advancement and Support of Education gave International and its partner, the City University of New York, its award for the Best New High School/College Collaboration in the nation. In 1989, the school received the National Council of Teachers of English (NCTE) award for Excellence in English/Language Arts Instruction, and in 1990 NCTE named it a Center of Excellence for At-Risk Students. The American Association of Higher Education gave its 1991 award for Outstanding High School/College Collaboration to International. In 1992, the school received both a Democracy '92 grant from RJR Nabisco and a National Academic Excellence award from the U.S. Department of Education.

Commitments and Practices at International

International High School describes its mission as fostering the "linguistic, cognitive, and cultural skills necessary for [students'] success in high school, college, and beyond" (International High School at LaGuardia Community College [IHS], n.d. c). The program that results from these commitments includes innovative instruction in English as a second language, a dramatically restructured school program and schedule, and more collegial and professional approaches to teaching. First of all, English as a second language is not taught as a separate course. Instead, students learn language skills by working with meaningful

content in their subject-matter classes, interacting with each other in small multilanguage groups that require them to use their native language and emerging English-language skills. Their tasks are constructed so that they must communicate ideas and directions to each other as they collaboratively produce and evaluate their work.

The Integrated Learning Center supplements other subject matter courses with small group interdisciplinary instruction. Classes are organized around themes that help students grapple with essential concepts (such as causality, commonality, interdependence, and relationship) and develop essential skills, like managing and using information, testing hypotheses, and generalizing. The center offers courses in communication, language skills, research, and cross-cultural studies, along with an orientation to the school and society. Extended-day opportunities allow students to participate in small-group tutorials designed to promote language competence, extend work in other subjects, explore career education alternatives, and participate in extracurricular activities.

Career education is an integral part of the curriculum. Students work in internship settings for half of each school day during one trimester each year. These experiences, generally in social service organizations, allow them to practice their English skills, develop work-place and life-skill competencies, gain confidence in their ability to cope with the social and cultural environment in their new country, develop a sense of responsibility, and explore career ideas. Accompanying coursework activities encourage students "to gain personal awareness through introspection," investigating their interests, abilities, and aptitudes, discussing the world of work, and preparing for interactions in the work place -- practicing job interviews, writing resumes, relating experiences, and suggesting solutions to problems they encounter (International High School at LaGuardia Community College [IHS], 1987-1988, pp. 28-30).

Located on the campus of LaGuardia Community College, International High School offers students access to college courses as well as its own core offerings. Over time, its internal schedule has evolved both to fit more congenially with the college schedule and to allow for more in-depth experiential and group work. Classes meet four times a week for 70 minutes each time. As teacher David Hirschy[1] notes, "The longer period encourages small group work, a variety of activities, and an in-depth treatment of topics that makes students more active participants in their learning" (1990a, p. 7).

Students take four classes each 13-week cycle, while teachers teach three courses each cycle, enabling them to focus their attention on a smaller number of students while extending and deepening the curriculum for their courses. In addition, each faculty member serves as an advisor to a house of 15 students, which meets for 70 minutes each week to address a variety of student needs including school-related issues; personal, social, or developmental concerns; and establishing peer-support networks and mentoring relationships. A number of

[1]Teachers' names are unchanged. Students' names have been changed and are marked with an asterisk.

teachers have formed teams to work intensively on an interdisciplinary curriculum with a group of students over the course of a complete 13-week cycle.

The schedule supports another critical feature of International's program: collaboration and participatory decision making among teachers. The time allotted for collective staff planning -- a half day per week while students are engaged in college and high school extracurricular activities, plus a daily planning period -- supports the committee meetings, staff development, peer review activities, and curriculum planning that enable the faculty governance system to operate and encourage continual innovation. The faculty's involvement in personnel decisions, curriculum development, and peer review and evaluation has proved to be a central force in the development of experiential learning and authentic assessment opportunities for the staff and, subsequently, students.

The staff-developed evaluation system at International involves teachers in working with a small, self-selected support team where they set their own goals, observe one another teach, provide feedback, present their work to the panel of other teachers, exchange ideas and practices, and evaluate themselves and each other. Teachers keep their own portfolios, which include the principal's and peers' observation reports; a self-evaluation, which addresses the teacher's contributions in the classroom, the discipline, the school, and the profession; course evaluation questionnaires from students; course materials representing their teaching work; and examples of student work. Through this process, teacher evaluation teams determine teachers' continuance at the school and tenure in the school system. Teacher evaluation, traditionally a private process between a supervisor and a teacher, becomes a public process, enlarging the sphere of accountability to the entire professional faculty.

The faculty's peer support, review, and evaluation system became a powerful force in shaping a common set of strongly held values and principles for guiding both the design and the practice of student assessment. Over time, student assessment practices have evolved from traditional, periodic tests and quizzes to a continuous process of self-reflection, peer assessment, and teacher assessment organized around collaborative performance tasks and individual portfolio development. Both the substance and the process of the assessments are authentic rather than contrived or removed from the act of learning. The work is hands-on, content-rich, aimed at the development of essential performance abilities and applications of knowledge, and connected to students' lives, experiences, and other coursework. A richly interwoven array of formal and informal occasions for evaluation creates the expectation that learning is a process of continual reflection and improvement in which every member of the school community is constantly involved.

The Evolution of Teaching, Learning, and Assessment at International

Three factors have contributed to the evolution of authentic assessment at International High School:

1. the development of a learner-centered, instructional model;

2. the resulting teacher dissatisfaction with traditional assessments; and

3. the staff-developed faculty evaluation system.

The Emergence of a Learner-Centered Instructional Model

As Eric Nadelstern, founding director and principal of International High School, emphasizes, International's practices did not begin with assessment. They began with an instructional commitment to student diversity as a generative force for learning. This focus inevitably led to authentic assessment.

David Hirschy, physics teacher, explains, "We wanted to create a total educational experience. We wanted to broaden the context for students' learning and deal with the whole person." In an article published in ***Insights***, the school's journal, Hirschy describes how he came to the realization that traditional, lock-step approaches to instruction could not meet this goal. Hired to teach physics at International after many years of teaching in a more traditional setting, Hirschy confronted the implications of student diversity in a more vivid way than ever before:

> It became apparent that many of the techniques that I used in teaching, when applied to limited English proficient students, simply didn't work. There were students who just didn't understand when I spoke to the class. There were students who had extensive science preparation in their native countries, and there were students who had very little formal education.
>
> The attempt to have all students arrive at the same place at the same time was impossible. Now the truth is that it is impossible with native English speakers also. It just isn't as obvious...
>
> Heterogeneity is not a problem to be solved. In fact when embraced, it is a positive force in the classroom. Students come to us at different stages of development and levels of preparation, and education increases those differences. In the long run, if a student is good at something, we try to encourage the student to pursue the interest, to excel, which results in inequality, differences, heterogeneity. It happens naturally. It is unreasonable

to expect that, as a result of our efforts, students should become less heterogeneous (1990b, pp. 16-17).

Collaboration between and among students and faculty is at the core of the learning environment International has created to celebrate and use this diversity to enhance learning. The expectation (and the reality) is that people learn from each other's different experiences and knowledge and from the synergy that occurs in the process of collaboration and communication, which expands each person's understanding beyond the sum of the parts. Hirschy explains:

> Collaboration, a combination of individual and small group work, and an environment in which variety is expected, allows us to capitalize on differences. The benefit to the slower student is having a model in the classroom and assistance from peers. The advanced students learn to meet high expectations in an atmosphere where variety is expected and to expand their responsibility to include others....Groups are especially appropriate for limited English proficient students because students need to use language to learn language. They need to talk with each other. They need to read instructions. They have the opportunity to repeat, to review, and to listen. It allows students to experiment with the content and with the language.
>
> The focus is on students learning rather than on me teaching. To paraphrase Piaget, every time we teach a child something we keep him from inventing it for himself. The goal is for students to assume responsibility for their own learning, and to discover how they learn best (1990b, pp. 18-19).

Hirschy had been long eager to increase articulation between math and science and was interested in Uri Triesman's development of cooperative learning models especially successful with minority students. In 1990, with the encouragement of Nadelstern, he organized the *Motion Program*, an interdisciplinary self-contained cluster that includes literature, an integrated math/physics course, and Project Adventure, a course modeled on Outward Bound but designed for the indoors.

The kinds of work students engage in during the *Motion Program* stretch their critical and creative capacities in many directions, while fostering collaboration and the ability to work with and learn from one another. Activities in literature, math/physics, and Project Adventure connect to the theme of motion and to each other. Many of the activities involve students working in groups on experiments that reveal and test the laws of motion, then developing charts, graphs, formulas, and prose to describe applications of such concepts as acceleration, velocity, and distance. In literature, students create a science fiction story that demonstrates and uses their understanding of key concepts from the physics and mathematics portions of the program as well as drawing on what they have learned from their study of literary forms and writing. One option is to create a story that involves people on a space journey and takes Einstein's theory of relativity into account. Project Adventure allows

physical expressions of the laws of motion and emotion (also part of the study of movement and change tackled in the program), while building trust and teamwork among students. Meanwhile, students' views of their physical and social-emotional growth -- and its relation to the themes of the course -- become the subject of portfolio essays.

The 75 students enrolled in this trimester-long program spend all of their time each day with the four *Motion* teachers and one assistant principal. This program has become the prototype of the International instructional model. The model is a self-contained, interdisciplinary, theme-based cluster -- a sort of temporary mini-school with its own teachers and students who meet each day, all day, and provide for the students' total education for the duration of a cycle (one third of a school year). Over the course of the cycle, teachers and students get to know one another well. Because of the model's success -- all of the 150 students who enrolled have passed -- Nadelstern's vision of International has evolved into an entire school of such clusters. The model has seven key characteristics:

- heterogeneous and interage grouping
- the creation of a learning community
- collaboration (teachers plan together and students work extensively in small groups with teachers alternately coaching, assessing, questioning, and prodding them; in groups students work on individual as well as group tasks)
- emphasis on critical-thinking skills and in-depth study
- active learning (students work extensively on problem solving and projects)
- whole language learning in context (language skills are taught within the context of subject areas)
- authentic assessment using multiple perspectives

Other faculty have begun to explore and experiment with the model. Teachers Anthony DeFazio and Charlie Glassman recently formed the *Beginnings Program*, an interdisciplinary program for entering students. They consolidated two theme-based courses, "Orientation to School and Society" and "Immigration," with the first course of the three-year *Personal and Career Development Program*. They then added biology to the interdisciplinary mix. DeFazio and Glassman are currently planning to expand *Beginnings* into an all-day, cycle-long, self-contained cluster similar to the *Motion Program*. These cluster courses, and the assessment strategies they use, are described later in more detail. The cluster concept has now become the organizing framework for coursework throughout the school.

Dissatisfaction with Traditional Assessment

As faculty at International found traditional assessment inadequate and inappropriate to their goals, they began to experiment with performance-based assessments. These early explorations into new approaches created the learning-as-assessment and assessment-as-learning dynamic that has come to characterize International's practice.

Hirschy, who in order to cope with the different achievement levels of students in his physics classes had been giving three different levels of tests, was disappointed with the results. Rather than measuring students' growth, the tests seemed to put a ceiling on student accomplishment. Nor did his tests measure skills that would increase learning, such as use of resources or collaboration. Hirschy's dissatisfaction led him to investigate portfolios as a means of evaluating a wide range of student work at a variety of levels over time, and do so in a manner that could provide incentives for ongoing feedback and revision.

When traditional testing practices failed to accommodate the wide range of students' abilities in spoken and written English, literature teacher Kathleen Rugger introduced projects that involved both individual and group work. One recent project, for example, involved pairing students to write each other a series of letters about books they were reading over winter vacation (Exhibit A). Describing what they were reading and feeling and asking questions about their partner's book involved students in an authentic dialogue that motivated their efforts to communicate while allowing them to learn from one another. In another project, students wrote their own myths to explain a physical phenomenon, and then traded them with another student to create different endings. In still another, students worked in teams to analyze a poem and then to write their explanations and interpretations. Along with her English department colleagues Dina Heisler and Marsha Slater, Rugger explains how such work allows them to attain the communication goals that are essential for their students:

> Although the content of an English class is important, we believe that if we only concentrate on teaching facts or specific applications of skills, most of what we teach will be meaningless for our students in the near future. In other words, if we concentrate on product and neglect the teaching of process, of the ability to create and develop product, we will do our students a great disservice, for we know that students will need to be able to produce a variety of written and spoken products....If they internalize strategies for reading any text, for accomplishing any writing task, for working together effectively in any group and communicating with each other, then we have fulfilled their basic English language needs (IHS, 1987-1988, p. 6).

John Stevenson, LaGuardia Community College professor of mathematics who also teaches the students in the *Motion Program*, asserts that traditional testing practices, while appropriate for traditional pedagogy, do not produce independent learners capable of working collaboratively with other students, "From a college perspective, all the research I've read

says that it's those characteristics such as independence and collaborative work skills that translate into successful college level work."[2]

Even worse, traditional assessment practices produced students who, according to Stevenson, "had given over all intellectual and even emotional responsibility for learning to a process that was teacher-dominated," as evidenced by such frequent comments as "He [i.e., the professor] gave me a C."

Stevenson believes that if students are given the responsibility for the process of their own learning, they will also take responsibility for the outcomes. In the natural progression of such responsibility, it will not be long before students take responsibility for assessing their own learning. The self- and peer-assessments used in the *Motion Program* encourage the goal setting and reflection needed for students to become responsible for directing their own learning.

The Faculty Evaluation System

Nadelstern strongly believes that there is an unavoidable relationship between the ways in which adults relate to one another in a school and the ways in which they relate to students. "If you have an authoritarian, hierarchical school structure," he explains, "the teacher becomes the information dispenser in the classroom. If kids are going to collaborate in classrooms, then teachers have to collaborate in decision making." At International, teachers are involved in hiring their peers, in designing and developing curriculum, and in developing and managing the peer support and evaluation system. As the introduction to the school's teacher-developed personnel handbook states:

> Shared leadership in a high school can foster the professional growth and development of teachers, leading to the empowerment of students as successful learners.... If we view ourselves as true educators, we must also view ourselves as learners. We are role models for our students. If we model authority, our students will learn to be authoritarian. If we model self-improvement in an atmosphere of sharing, that is what our students will learn. (International High School at Laguardia Community College [IHS], n.d. a, pp. 4-5).

Before teachers at International found traditional student assessments inappropriate, they first found traditional teacher assessments inappropriate:

> The traditional evaluation procedure [teachers] had experienced in their many years of teaching was humiliating, intimidating, and punitive . . . viewed as destructive by some, mechanical by others, and not something to be taken

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[2] Quotations not identified by specific documents or publications have been taken verbatim from interviews with International High School community members.

seriously by others. Its authoritarian procedure [gave] little or no consideration to the needs and abilities of the teacher (International High School at Laguardia Community College [IHS], n.d. a, p. 4).

With encouragement and steadfast support from Nadelstern, who views the idea of supervision with skepticism -- he is fond of asking, "Who has the higher vision?" -- the personnel committee developed an evaluation system that centers on, supports, and takes responsibility for the professional growth and development of teachers.

As teachers developed their own system for peer review, collegial support, and evaluation, they began to appreciate the power and potential of collaborative problem solving, self- and peer-assessment, and exhibitions of their work for enriching their professional learning and development. The faculty review and observation process has a number of goals, which are remarkably similar to the goals International holds for students' learning:

- Exposing faculty to a wide range of methods and techniques
- Enabling them to develop a philosophy of what constitutes effective teaching and counseling
- Encouraging them to view their own behaviors differently, in light of the professional practices of others
- Promoting experimentation with new approaches and strategies observed
- Facilitating the sharing of ideas and insights with their colleagues
- Institutionalizing the process of continuous self-evaluation (IHS, n.d. a, p. 6).

The principles undergirding the faculty evaluation system have increasingly found their way into classroom practice, as teachers have worked to create the kinds of learning environments for students they find helpful for themselves. Among these are an understanding of and commitment to ongoing assessment, self-directed learning and assessment, evaluation of both process and product, and evaluation from multiple perspectives by multiple colleagues. Their own faculty assessment system has provided a helpful reference point for teachers as they have struggled to make their classrooms learner-centered rather than teacher-centered. DeFazio asserts, "The school is organized to bring out the best, not the worst, in teachers and kids." Nancy Dunetz offers this powerful analysis:

> An American education is one that fosters competition. Competition leads to hostility, isolation, secretiveness, and shame. Collaboration, on the other hand, provides many benefits, as it has done for me. First and foremost, it promotes a feeling of self confidence. It provides a supportive environment to help me

> feel secure not only in presenting what I know is good, but also in allowing me to feel secure in examining my weaknesses on my own and with others....Collaboration furnishes recognition for everybody, because each party naturally acknowledges the contributions of the others. It helps me to think because I receive input from others and am exposed to a greater variety of ideas and information. So it also broadens the scope of what I can produce. It provides a feeling of community, which I haven't experienced in other work environments....Experiencing that environment myself makes it possible for me to provide it to my students (Dunetz, 1990, p. 5).

Both the spirit and the components of the student assessment process reflect the faculty's assessment system and their experience with their system. Kathy Fine, *Personal and Career Development* (*PCD*) teacher, says:

> I have learned quite a bit from the way we work ourselves as a faculty. Everything sort of trickled up and down. There's been tremendous interplay between what we do as a faculty and how we work with our students. We've all had to deal with issues of discomfort around evaluation that our students would have to deal with and that our students do deal with. It made the school a learning laboratory where evaluation is not just for evaluation's sake, but a service to the person being evaluated.

This stance is clearly evident in the assessment practices teachers have developed for their students, as well.

Assessment Three Ways

The basic features of International's faculty evaluation system, a collaborative approach involving self-assessment, peer assessment, and supervisory assessment, are, not surprisingly, central features of classroom assessment throughout the school. Several of the interdisciplinary cluster programs have developed particularly innovative authentic assessment practices. Three of these -- *Beginnings*, the *Personal and Career Development/Internship Program*, and the *Motion Program* -- are discussed here to illustrate the range of practices being developed in the school. Although each program's practices are somewhat different, self-assessment and self-improvement are emphasized as they are in the faculty assessment system. These similar emphases occur for the same reason: the belief that "individuals have a greater commitment when they identify their own needs, and their standards are higher when they set their own goals" (IHS, n.d. a, p. 5).

Of these three programs, the *Motion Program* has the most completely developed system. However, each contains these common components:

- ongoing performance-based assessments conducted while work is in progress and providing feedback toward improvement
- summative assessments that evaluate student work according to multiple dimensions
- assessment of both the processes and products of individual and group work
- evaluation from multiple perspectives

The following table summarizes each program's assessment practices:

ASSESSMENT COMPONENTS	PROGRAM ASSESSMENT TOOLS		
	Motion	**Beginnings**	**PCD/Internship**
ongoing assessment (while work is in progress)	debriefing, exhibitions	coaching, group work, exhibitions	group work, seminar, internship site visits
final assessment	written evaluations, conference	conference	written evaluations
process and product	classwork, group work, portfolio	group work, autobiography	internship, album
multiple-perspective evaluation	self, peers, teachers	self, peers, teachers	self, peers, teachers, site supervisors

Assessment in each of these programs is described in the next section, starting with *Beginnings*, one of the first programs students encounter at International, followed by the *Personal and Career Development* (*PCD*) strand, which they follow for three years; and the *Motion Program* -- perhaps the most sophisticated set of interlocking curriculum and assessment practices. Each of these provides a different lens on assessment as it can be used to support the different purposes of education.

In the *Beginnings* program, the goals of teaching are to help students learn about themselves and how to live in a new place; to come to grips with the major change that has occurred in their lives; to take stock of who they are and what they want to become; to learn

about the United States; and to create new relationships, while beginning to learn English. In this program, assessment practices require that students work with one another, reflect on their lives and experiences, and communicate extensively both orally and in writing.

The *PCD* sequence focuses on career development, learning about work and oneself, and developing work skills and responsibility. Assessment practices are structured to provide students with feedback from work supervisors as well as from peers and teachers, to focus on the development of a range of practical as well as academic skills, and to provide structured opportunities for reflection on students' excursions into another new terrain: the world of work.

The goals of the *Motion Program* are more traditionally academic, though they are pursued in a nontraditional fashion. In this program, knowledge of physics, mathematics, and literature is as important as the development of communications skills and general problem-solving abilities. The assessment practices focus on mastery of essential concepts and applications of knowledge in these disciplines as well the development of students' abilities to frame and structure problems, conduct experiments, and evaluate what they have learned, generalizing it to new circumstances.

Assessment in the *Beginnings Program*

The principles of multiple-perspective evaluation, of process and product assessment, and of formative and summative assessment frame assessment in the both the *Beginnings* and *Personal and Career Development* programs. These programs integrate personal, career, and academic learnings and develop values and habits of work that correspond to those of the work place.

Beginnings features an interdisciplinary consolidation of three courses -- biology, social studies, and English as a Second Language -- aimed at those newly enrolled at International. Here, students construct an autobiography including chapters on their childhoods, life in their countries of origin, their milestones, their immigration, their responses to the United States, and self-assessments of their interests, abilities, and skills in the context of career exploration. They first learn the mechanics and process of self-assessment by doing self-assessment. Specific activities guide them through the processes of reflection and decision making so that they are able to identify their interests, aptitudes, and values. They are then armed with information to investigate possible work and career paths.

For example, a student who identifies fashion as an interest, and interpersonal relations as a skill, and who enjoys interacting with people, might consider exploring careers in fashion sales or public relations. Such a student might then apply for an internship in the fashion field. In fact, students do use the information they derive from these activities later to decide on internships, which they select from over 200 possibilities ranging from human services to profit and non-profit businesses, from technology to the arts and cultural institutions.

The autobiographies are developed over the course of an entire cycle. At the conclusion of the cycle, they become major products demonstrating student achievement. Throughout the cycle, students, seated around tables in groups of five or six, work independently and collaboratively on their autobiographies. They regularly share their chapters on an informal basis with their peers, who give them feedback for revision. They use one another as resources to help with language difficulties and stylistic considerations. Co-teachers DeFazio and Glassman intersperse these activities with short lessons targeted to specific needs and coach students as they work individually and in groups.

DeFazio and Glassman want students to develop "an internal standard" that will drive them to work up to their potential. The development of a self-motivated work ethic is more important than any other goal to both teachers. Through ongoing reciprocal peer assessment, explains DeFazio, students learn to expand their expectations and to redefine their standards. Peer assessment creates opportunities for students to enlarge their field of possibilities, extend their imagination, and increase their learning strategies and skills.

The use of collaborative work groups also allows students to see and experience alternatives to their own approaches: alternative habits of work and strategies for learning, which they can adopt and adapt. Reciprocal peer teaching accompanies reciprocal peer assessment. As colleagues give feedback, they also give advice and assistance to members of their group. Glassman underscores the significance of assessment as a learning tool: "Assessment is a mechanism for learning, understanding, and acquiring knowledge, not giving a mark to something. In *Beginnings* [the students] are doing it all of the time."

Assessment is formalized twice during the cycle when students gather in small groups and make presentations of their autobiographies, evaluating them and receiving feedback from their peers, who also evaluate each work. Evaluation focuses on completeness. Completeness encompasses more than the completion of all tasks or the inclusion of all parts articulated in the ***Beginnings Activity Guide***. Completeness is also determined by the impact the autobiography has on the sensibilities of the peer readers and their responses to it. Does the autobiography communicate a sense of completeness to the reader? For example, did the readers want to know more about the various events and places in the autobiography? Did they understand what the author was trying to convey? Did the autobiography sustain the reader's interest? These are not "school" criteria; they are authentic criteria used by readers in real life. From the responses of their peers, students learn whether they "did enough" or "got tired and quit." Students rate themselves on the basis of such criteria, designed to focus their attention on the correspondence between product quality and such habits of work as perseverance.

At the conclusion of the cycle, a formal summative evaluation takes place. Each student meets with the three *Beginnings* teachers and two peers whom he or she has selected. At these conferences, students are expected to exhibit critical-thinking skills and a capacity for applying standards in evaluating their work. They discuss their best work. They identify and analyze the elements that make it their best work. They explain the connections they

made across content lines. Together with their teachers and peers, they determine a final grade, which ranges from A to NC (i.e., no credit).

Assessment for improvement extends to the *Beginnings* faculty. Students evaluate the *Beginnings* course. DeFazio and Glassman use student feedback to revise the course, which is still in its formative stage, for closer alignment between goals, activities, instructional strategies, and outcomes. At the end of the course, the teachers ask students to write them letters evaluating the program. Glassman notes, "We ask them what they don't like." DeFazio adds, "Also, what connections they saw between the various parts of the course. If the answers are not terribly well thought out, then that's a place that we have to work a little harder." Both teachers caution that students tend to say "nice things even if they hate the course." Glassman comments, "You have to want to look at your work with a critical eye," so as to distinguish affirmation from information. Glassman and DeFazio use assessment as a tool for their own learning, for the development of curriculum, and for the construction and refinement of their instructional model. As they use assessment and learning dynamically, they increase their capacity to derive deeper understanding of their students' responses; this then serves to structure increased learning opportunities.

Assessment in the *Personal and Career Development Program*

The career education program at International consists of a three-year course sequence in personal and career development, known as *PCD* 1, 2, and 3 (the first of which the *Beginnings* team has integrated into their cluster), and three internships accompanied by weekly seminars. The program emphasizes informal but ongoing self-assessment as a tool for achieving self-knowledge. Self-examination, which is the thrust of the first *PCD* course, expands in the second course to the examination of work-place issues. *PCD* teacher Kathy Fine explains that concepts "spiral up" throughout the course structure over the three years. Academic and career learning are integrated as students craft and write resumes and business letters, develop job interview skills, and examine the work place from a sociological perspective, studying such issues as hierarchy and authority, gender, and organizational structures while they are engaged in their internships.

During the three cycles of internships, students report to their work site four days a week and to school one day a week. They are expected not only to learn the job they are doing at the work place but also to develop interpersonal skills as they interact with supervisors and employees, examine the culture and organization of their work places, and think about career implications. The seminars help them reflect on and use their work experience to learn problem identification, problem analysis, and problem-solving skills that they can apply at the work place. As they develop practical and social work-place competencies, they are better able to make and keep commitments. In many instances, the skills students need are so basic they might easily go unnoticed and untaught in a school where self-assessment and inquiry were not highly valued. For example, students who have been unsuccessful in scheduling appointments for interviews with work-place supervisors frequently need to learn the discrete steps involved in making appointments or the strategies

for circumventing small but persistent obstacles. Others need assistance and assurance in managing the competing tensions of responsibility to a supervisor and fear of disappointing adults, so that they will call their work-site supervisor when they are going to be absent.

Fine reports that students transfer the socialization and communication skills they learn in the internship seminar to their internship sites:

> The kids learn to negotiate, mediate, to defend their positions....Most of them practice these skills at their internship sites. They learn -- and we teach them -- the importance of being assertive without being aggressive if they feel they are being used unfairly.

When students invariably complain about problems at their internship sites, the teachers do not intervene. Rather they present the problem to the class for analysis. After assessing the situation, the class generates possible courses of action to resolve the problem. Students employ the same problem-solving and analytic thinking skills to academic problems that they use to solve work-place problems.

In the internship seminars, instructional activity and authentic assessment work conjointly. Students construct internship albums that integrate their academic and career learning. Like the autobiographies in *Beginnings*, the internship albums are cycle-long projects that become both products demonstrating students' achievement and records documenting their progress. An activity guide outlines the tasks for the album's four chapters. Each chapter engages students in a process of analytic self-assessment along with knowledge and skill building. Students identify their personal and career objectives and articulate rationales for their internship choices. They describe their job interviews, typical days, job duties, and the organizational structure, relationships, and roles at their work place. They interview co-workers and supervisors about their own career development, education, and job satisfaction as well as the salary range, benefits, and employment opportunities in their career fields. The interview topics themselves create a framework for thinking about work that will increase students' knowledge about work-place issues. They reflect on and analyze their work attitudes, along with the skills and competencies they are acquiring and need to acquire. They analyze what they have learned about work and about themselves. They compare their current internships with previous ones. The album used to record these reflections allows students to simultaneously learn about the process of bookmaking and to develop their writing skills.

In the last course of the sequence, Decision-Making, students expand their self-exploration to include the external forces that influence them, their behavior, and their decisions: peer pressure, home pressure, and adolescent developmental pressure. Since students take this course in the eleventh grade, when they will start to think about postgraduation career and education plans, they reflect on processes for decision making, analyze their personal decision-making strategies, and prepare for their third and final internship. Once again, the use of self-assessment as a tool for self-knowledge is emphasized.

Learning and assessment are interactive. Working both collaboratively and independently, students regularly share, review, and critique one another's chapters, which results in the continuous revision of their work. The completed albums become part of a library of internship albums to be read by other students who are researching internship placements. In this way, students' products become curriculum resources for their peers, attaching added value and worth to their work.

The formal summative evaluation includes the multiple perspectives of self, peers, and faculty, and in this case, worksite supervisors. Kathy Fine and Ronni Green, another *PCD* teacher, formulated the evaluation criteria for both the internship album and the students' performance as interns. In their assessment of the albums, peer evaluators record their reasons for choosing to read the album, their personal reactions to it, and their recommendations for future improvement. On a scale of A through C, with each letter corresponding to specific indicators, they rate the album on completeness, content (i.e., level of interest, clarity, degree of detail, supportive evidence, and creativity), language usage, and presentation (i.e., aesthetic considerations).

Work-place supervisors rate students on a five-point scale ranging from poor to excellent according to nine indicators: attendance, promptness, quality of performance, dependability, cooperation with both co-workers and supervisors, ability to learn, initiative, and growth. The numerical sum is converted into a grade ranging from A to NC. The students complete a questionnaire in which they assess their albums and their internship performances, taking into account the assessments of their evaluators. If their assessments differ from their evaluators' assessments, they explain their reasons. As in the *Motion Program*, students engage in a process whereby they can square their assessments with those of their judges. Finally, the teacher assesses the students on the basis of both the album and the internship performance. All evaluations are factored into the final grade.

Assessment in the *Motion Program*

The *Motion Program* assessment system is multifaceted and cumulative; it contains a variety of occasions for assessment throughout the course that build on one another. The assessment process has three major components:

- debriefings,
- two portfolio reviews (mid- and end-cycle), and
- the final conference.

Opportunities for self-, peer-, and teacher-assessment of students' learning processes and products occur in each of the components. In all cases, collaborative work serves both to foster the development and internalization of high standards in the assessment process and to enhance learning so that those standards can be met. Because collaborative work is central to the entire program, we first discuss how students experience the process of group work before discussing how each distinct assessment component operates.

Collaboration for Learning and Assessment. The use of assessment to drive collaborative learning produces one of the most powerful experiences *Motion Program* students have. Students work in groups to design experiments and solve problems in mathematics and physics, to interpret literature and write to and with one another about books and ideas, and to conquer physical challenges in Project Adventure. Throughout these activities, they must surmount language barriers to communicate with each other -- thus, they are forced to learn and use English for authentic purposes around complex, content-rich tasks -- and they must surmount the challenges of different styles, approaches to work, and prior levels of knowledge.

These challenges are particularly salient in the culture of American schools and American assessment, where traditional norms view accomplishment as individual and competitive, collaboration as cheating, and the ranking of students against one another as an important school purpose. There is an ingrained fear in American culture that cooperation will make people "soft," will undermine the competitive edge that many believe produces achievement, and will blur the distinctions between the fit and the less fit that Darwinian sorting policies rely on. At the same time, schools are now being told that the demands of the modern work place require that students be able to work effectively in teams to solve problems. Strategies for accomplishing this new goal remain a mystery to many. Thus, the ways in which the *Motion Program* and other courses at International are structured to enable students to use collaboration to spark greater growth from all students, to acknowledge individual effort along with group achievement, and to increase the levels of achievement for both individuals and the class as a whole are worth taking some time to understand.

Since group work is used in all four of the courses that make up the *Motion Program*, students develop a complex view of their peers' capacities and of the nature of cooperation and collaboration. Students reveal different strengths in different areas, so that group dynamics are fluid. Natasha Ulanova*, who emigrated from Russia two years ago, articulates the interplay between successful group interaction and learning that is echoed by her peers:

> I always found out that some people know something that I don't know, and I can tell them what they can't do. We learn from each other. There is nobody who knows everything best than somebody else. Once people feel important, that they could be helpers, then they open up and talk. First they are very scared.

Olga Szpilowski*, originally from Poland, explains the fine-line distinctions that lead to group improvement: "The group work depends on how well everybody do. Therefore, it's in the interests of everybody, not to criticize everything possible, but just to improve things."

These positive responses to collaboration are hard won. As Rafael Suarez's* portfolio commentary on group work indicates, the collaborative process includes widely shared frustrations, tensions, and discomfort:

> The best and the worst moments were working in groups. When the group started working on the project, the group wanted to finished it very fast because they will get credit and sometimes they did the project very fast. But when they had to present and give back the papers to the teacher and see if it was right, the project had many mistakes. The students had to do over almost all the project and it made feel angry and sad the students.
>
> When the group was working right and each member was doing and working on the project, it means that each member was giving ideas and adding new things to it. They may sured [*sic*] that each member of the group understood the project...that they took the appropriate time to organize the presentation to the teacher responsible of the activity. When the group made a very good presentation the teacher congratulate them because the members of the group demonstrated the organization.

Students must learn to tolerate the competing tensions between individual and collective interests and seize control of opportunities to make the two forces work in tandem. Students progress from feeling conflicted by this double agenda to feeling confident that they can competently cope with their circumstances. Olga reports:

> At first I couldn't stand working in groups. I'm used to work on my own. I felt that if I have to do something with other people, I may not get result I want to get. Maybe because they would come late or will not participate. But later on when I got to know them, I feel strong enough to push them to do the work, then I built up that leader skill in myself. The work in groups really began to work for me. Most of the time people don't cooperate when they don't understand something. So if I knew that they do not understand, I try to explain it to them. Then I get some feedback, maybe they started to understand, and they get some new ideas, and they were feeling comfortable enough to share with me.

WenFu Wong*, a Chinese student who has lived in the United States for three years, articulates the risk of rejection and alienation students surmount when they begin to take responsibility in their groups, especially when they must transcend ethnic barriers by speaking English rather than their native languages and by engaging students from ethnic groups other than their own:

> It's so hard. At first, students just didn't want to speak English, including me, myself. It is uncomfortable, because when students have questions, the first language that come up in their head is their native language. They might translate later on, but at first it get on your nerves. You feel left out. You have to talk to the people who do this to resolve the problem.

To help students transcend the barriers to collaboration and communication, *Motion Program* classes are structured so that students must always sign up to work on activities with students they have not previously worked with or do not know well. As Miguel Melendez*, recently arrived from Ecuador, reports, the most frustrating experience in group work is "when the people doesn't want to work with you." But, he adds, teachers are available to mediate when groups cannot get themselves on course. In the long run, they virtually always do.

Natasha explains the anxiety and doubt students struggle with when the group has not yet begun to collaborate. She understands that students take different paths to collaboration and that collaboration is more than a *quid pro quo*. She explains the motivational pressure of collective evaluation. When her group was not on task, Natasha felt resentful that lost time would result in lower grades for herself than if she had worked alone. But she found that, over time and for a variety of reasons, the group started to work:

> Time passes. Some people get very scared because they realize they are not going to get credit -- you get one credit for all four classes. If you're getting a C, you're getting all four Cs. Some people got interested in experiments and some people built up the trust. But the work in groups started to work. And if you work for the group, if you push them sometimes, and you give them your ideas, then the group will give the feedback to you. They will work for you. They won't be late. They won't be talking around. They will be trying. It's not "I work for you, you work for me." It's all together.

As we describe below, the assessment process skillfully supports this difficult transition from uncertainty and fear to collective capacity for achievement in a variety of interlocking ways.

Debriefings. In each of the four *Motion* classes, assessment occurs throughout the cycle. Whenever a group completes an activity, they participate in a process known as debriefing. At debriefings, the group members make a presentation to their teacher and sometimes to their class to demonstrate their mastery of the content and the collaborative learning process. The debriefing, which allows students to reflect on what they have learned and to explain it orally to someone else, is the means by which the group can achieve credit for the activity. Preparation for and performance of the debriefing also enrich the students' understanding of what they have learned.

The teacher sits with each group and has a conversation in which she or he asks a series of questions that spiral in complexity so that group members can demonstrate their individual levels of mastery. For example, in the study of inertia, the questions students will be asked in the debriefing range from "What is inertia?" to "If you took two tennis balls [which the students have been experimenting with in the activity] into a spaceship in a weightless environment, how could you tell the difference between them?" (International High School, Middle College High School, and LaGuardia Community College [IHS et al.], 1991, p. 213). The levels of mastery and capacities for explanation will differ because the groups

are heterogeneous and students' English capacity varies. Although each individual in the group must demonstrate an understanding of the concepts in the activity -- for example, inertia -- *the group*, not individuals, receives credit. The group-credit strategy provides students with the incentive to collaborate, to use and learn English while they are learning subject-area content, to learn and practice collaboration and social responsibility, and to persevere during frustrating and discouraging moments. Without incentives to persevere, it becomes all too easy to retreat to isolated and isolating learning strategies.

Debriefings provide teachers with critical feedback on the effectiveness of the curriculum and of specific activities. This information forms the basis of curricular revision. Debriefings enable teachers to see what students know, to understand how they got to know what they know, and to get to know the students as individuals and as learners. Hirschy explains:

> By the time the portfolio comes along, we've sat with all of these groups maybe ten or twelve times in conversations with them about the work that they've done. And in those conversations, it starts to emerge who really masters this. It comes out in those conversations. We don't necessarily mark it at those times, but everybody gets to know each other. You get a pretty good idea of how people approach and solve problems and have an assessment of their ability to solve problems.

Because the debriefing process is designed to strike a balance between a common rigorous standard and differences in ability and achievement between and within groups, it supports and sustains heterogeneity as both a pedagogical strategy and a democratic value. Students may differ in ability and achievement levels; they need not feel either embarrassed or underchallenged, however, because the diverse questions give all students multiple opportunities to demonstrate their intellectual capabilities. At the same time, the different levels of students' responses set a standard of possibilities: Students experience a range of responses toward which they can aspire. Because each member of the group must demonstrate an understanding of each activity's concepts in order for the entire group to receive credit, the debriefing process reinforces interdependence and responsibility among group members for the group as a whole. When a group does not receive credit for an activity, it reconvenes itself and reviews the activity until all members can perform adequately.

A debriefing conducted by Hirschy illustrates a number of the points mentioned above. A *Motion Program* group, having completed a series of activities requiring them to examine the relationship between the Fahrenheit and Celsius temperature scales, present their results to Hirschy. Using both scales, the students have individually measured the temperature of seven different places in the school, recorded their data on charts, and plotted them on graphs using different axes for each scale. After having interpreted one another's data, they converted them into linear equations.

At the debriefing, Hirschy notices that the data the students have collected do not match the data displayed in the computer graph they have produced. After he challenges the data on their computer graphs as "invented," the students understand that they must return to the computer to replot their data. Emilio Cruz* questions Hirschy to clarify his assessment. Amalia Fresne* rephrases Hirschy's responses using her own constructions. The two remaining members of the group listen. Emilio takes the lead at the computer, replotting his data as three girls watch, occasionally offering suggestions. After a few tries, Emilio gets it right. When he begins to key in the data for another member of the group, Hirschy wants to know if the girls are letting him do the work because they are uncomfortable with the computer. They assure him they are not and become more active in directing Emilio's actions, although they do not make any effort to work at the computer themselves. After the graphs are printed, Hirschy and members of the group listen to one another as they recapitulate the processes they used to convert the data on their charts to the graphs.

They must now reconstruct their equations. Again, Emilio takes the lead, articulating the process to convert their data into equations. As he plots out the process, however, he becomes aware that he is not quite confident of it, and the three girls reveal that they are also unsure. Hirschy directs them back to a previous activity on mass in which the steps for writing equations were explicit. (In contrast, their current task requires the consolidation and application of prior knowledge and skills.) Hirschy wants the students to reinforce the concrete process of constructing equations for themselves so that it becomes intuitive. Hirschy's redirection helps the group recall the process they used to construct equations in the mass activity. As they recapitulate the process, their discussion grows livelier, with all group members contributing actively. Having observed the team working, Hirschy later suggests that they create an activity for another class, perhaps an activity on conservation of momentum. He will give the students equipment as well as material to read. Hirschy suggests that they experiment until they come up with a clear and accurate procedure for their activity, which they can record for another group.

> Hirschy has punctuated this debriefing with challenges that allow for differentiated responses from students. His questions and directions have emerged not from a preconceived agenda or lesson plan so much as from his analysis of the immediate and specific context of the particular encounter; his knowledge of the group, its members, and its dynamic; his knowledge of physics and mathematics; and his pedagogical craft, all of which enable him to orchestrate the learning situation. Effective debriefing requires teachers to use their combined knowledge of content, pedagogy, and individual students to create an occasion for assessing and stimulating learning that sets standards without requiring standardization, that values a variety of students outcomes, and that is respectful of developmental variation.

The Portfolio. If the debriefings provide a moving picture of students at work, then the portfolios are a series of snapshots reflecting student progress and achievement at two points in time: mid-cycle and end-of-cycle. The *Motion Program* portfolio has four components, which are clearly explained in the portfolio directions reproduced on the next several pages.

The major components include:

1. Data Summary and Samples of Student Work

2. Personal Statement (a self-assessment essay)

3. Mastery Statement

4. Self-, Peer, and Faculty Evaluation (assignment of grades)

Following is a description and discussion of each component.

1. Data Summary and Samples of Student Work. For both the mid-cycle and end-of-cycle portfolios, students provide data on the number of times they have been absent or late, the number of activities they have completed, and the titles of the work samples they have included in the portfolio. These data are recorded separately for literature, math/physics, and Project Adventure. Except for two required entries for the end-of-cycle portfolio -- a reading log identified as successful by the student and a math/physics problem entitled, "The Hunter and the Monkey" -- all of the student work samples in the portfolio are selected by the students themselves as representative of their best work during the cycle. Although students have an opportunity to rework the activities they plan to submit in the portfolios, the faculty encourages them instead to record and substantiate their growth in the Mastery Statement, a documentation of accomplishments, combined with demonstrations of mastery of core concepts and reflections on learning.

Almost any combination of the 60-plus activities in the *Motion Program* curriculum can be found in a sampling of student portfolios. Literature entries are illustrative: Students may include a myth they wrote to explain a natural phenomenon or a science fiction story they created to demonstrate their understanding of key concepts in physics and math, such as Einstein's theory of relativity. These also demonstrate students' understanding of literary forms and their developing writing skills. They may choose from other imaginative literature activities such as "Graphing Lives," "Laws of Motion in Life," and "Mind Movement." They may include a piece of autobiography they wrote illustrating an important decision, or submit reading logs they wrote while working their way through a piece of literature. The autobiography and reading log included in the portfolios of two students and shown in Exhibit B illustrate tasks that enable students to connect their reading and writing to their own lives and thoughts.

Another entry, entitled "Southbound on the Freeway," illustrates how a poem, which reveals the limitations in view imposed by perspective, can be used to provide links to other coursework in statistics. The prompt for student analysis is a poem in which aliens draw conclusions about life on earth from their spacecraft hovering over a highway. Following her analysis of the poem, Natasha writes:

In poem which calls "Southbound on the Freeway" the narrator made a mistake. He talks about cars like about human beings of earth. He saw cars from his space car, where sit bodies and he thought that they are like brains or guts. Of course it is mistake too, but why he made this mistake? He's never saw our planet before. And how he'll understand our planet, what creatures living here, it depends on what point of view he chooses or takes. His point of view is in the air above heighway [*sic*]. Of course he can see only cars which move to different direction, which are made of glass and metal, and through the glasses he can see bodies and he thinks that it's inside (brains) of creature. The same mistake we can do in physics and math experiment which was called "Statis-tick." For example, we have to describe tick population which has 5 different colour, and if you take only 2 of them, you'll not be able to describe what do you need. The same situation we can notice in poem. The narrator made important mistake because he judge about our planet from only one point of view. To correct his mistake he can if he look at other place, for example a park or beach.

The important concept of how much and what kind of evidence is needed to draw accurate conclusions about phenomena is a running theme throughout the *Motion Program*, in math and physics experiments as well as in literature. The emphasis on the interconnectedness of content areas encourages students to struggle to make their own connections as Natasha does in her analogy about perspective. The portfolio becomes a tool for encouraging students to make original connections and to synthesize their ideas, learning, and experiences.

From the physics portion of the program, students can include charts, graphs, and formulas they have developed in the course of problem solving for activities such as "Statis-Ticks," an exercise in which students use statistical methods to calculate the level of danger of the deer tick population in a particular location, or "Temperatures," which leads students through experiments and calculations that establish the relationships between Celsius and Fahrenheit and help them learn to develop and graph equations. Work samples may also include discussions on the applications of such concepts as acceleration, velocity, and distance. Two examples of portfolio entries are included in Exhibit C.

Project Adventure entries may include narratives on the physical expression of the laws of motion and emotion as well as responses to "Trust Activities," "Decision Making and Problem Solving," and "The Ropes Course." In the Project Adventure entries, students' views of their physical and social-emotional growth -- and its relation to the themes of the course -- become the subject of portfolio essays. These themes also emerge in the personal statement and mastery statement described below.

The two activities required for the end-of-cycle portfolio assess students' consolidation of their learnings. "The Hunter and the Monkey" is an activity that consolidates many of the concepts in the math/physics course: "free fall, projectile motion, reaction time, formulas for

constant speed and accelerated motion, and the independence of horizontal and vertical motion." It requires students to demonstrate skills they have developed during the course: the capacity to assess initial conditions and assumptions in predicting outcomes (IHS et al., 1991, p. 232).

Olga's response to "The Hunter and the Monkey" illustrates a clear understanding of the concepts of gravity, acceleration, velocity, and reaction time and a capacity to apply mathematical and practical reasoning skills. The beginning of her answer, in response to a scenario posing a hunting situation, is a good example of how students have learned to reason through problems in the *Motion Program*:

> The hunter may or may not hit the monkey because we don't know the D from what hunter is shooting. This is very important, and without D we can't give the exactly answer. Let's try to count the minimal D from what hunter will hit. This means, if he'll shoot from the more D than the minimal he'll miss, if he'll be closer he'll hit. In order to count the D, we need the t, ($D_m=V_{bullet}$ x t). t= 2s/g (s=g 1/2 ^{2}/2). If the hunter aimed in the middle of the monkey, s=1/2 x 0.30 = 0.15. t= 2 x 0.15/ 9.8 = 0.175 sec. $D_m = V_b$ x t, D_m = 700 x 0.175 = 122.5m. As you see, if hunter will shoot from the 122.5m or less than this D, he will hit, if more than 122.5m he'll miss because monkey will have time to pass the danger area.

Olga continues to evaluate the reaction time of the monkey, the trajectory of the bullet, the effect of gravity on the monkey's motions, and the relative safety of the monkey if he responds to the light of the rifle shot versus the sound of the shot.

In an excerpt from his written assessment of this portfolio, teacher John Stevenson reveals his goals for student work and criteria for evaluation:

> Your work on the "hunter-monkey" was inspired. The analysis was sophisticated, subtle, lengthy, and original -- it represents exactly how mathematicians and scientists really operate. What's more you seemed to enjoy working on the problem for its own sake -- not for fame or praise.... Your commitment to clarity and precise articulation has not only enhanced your own linguistic skills but also established you as a "go-to-person" for the class. Others will go to you for clarification, discussion, etc.

This kind of exercise allows students to integrate what they have learned and to demonstrate their capacity to apply concepts to new problems. At the same time, it allows teachers to see how they have succeeded in developing students' deeper understanding of core ideas and thinking processes. Embedding such tasks within a broader array of work samples selected for the portfolio by the student gives both students and teachers an opportunity to reflect on areas of proficiency and areas of progress in terms of both mastery of content and development of communications and personal skills.

2. Personal Statement. In the personal statement essay, students reflect on and express the progress they have made as individuals and as members of work groups. In the mid-cycle portfolio, they assess their strengths, areas of difficulty, and goals in six areas: language and communication skills, individual work and responsibility, group work and participation, work with adults, academic growth, and overall progress. In the end-of-cycle portfolio, students assess the personal goals they have achieved. They articulate new goals, accomplishments they are proud of, and their learning from collaboration with others. Rafael, who is originally from Honduras and has been in the United States for less than one year, writes:

> I was very unsure in the first days of school, and I hope that the rest of the class were unsure too. I thought this because when I came to International High School, in my mind was that I could be reject [*sic*] by the students and the teachers because my English level wasn't so good, and my pronunciation wasn't very clear but it didn't happen. The teachers and the students included me to all the activitles. . . .
>
> I developed my English, *not because it was willingness. It was because the system which this class has practicing.* All of the activities worked in me and were very good to my memory center. . . . I learned many vocabulary from those activities: "Jabberwocky," "The Road Not taken," "The Pit and the Pendulum," "The Eye and How You See," the light project in physics. . . physics equations, the name of the equipment of the physics room . . . the symbols of the slope of the graphs. . . and the ropes and the knots in Project Adventure. For all of this activities, I am now feeling surer when I speak English and that mean I don't feel unsure like in the begginning [*sic*]. [Emphasis added]

From Rafael's perspective, the *Motion Program* learning environment fosters personal and interpersonal learning, develops competence in language skills and content, and creates a foundation for growing self-confidence. Despite his still-developing competence in English, the portfolio process allows him to demonstrate his ability to clearly articulate his insights about the group process. His limited English proficiency is not an obstacle to his learning. He effectively communicates his views, priorities, and areas of learning. The honesty of his assessment and his willingness to expose his vulnerability is a tribute to the trust he has in his audience and their respect for him. The personal statement gives Rafael's teachers access to his agenda and to his learning processes, needs, and values, while informing them about the impact of their curricular and instructional decisions.

The personal statement reveals that what is most important to Rafael is improving his English. While he is glad to have been well accepted at International where all of the students are immigrants, he remains convinced that acceptance by his new society is contingent on his acquisition of English. His increasing self-confidence is directly related to his perception of his increasing language competency. As he refers to the new vocabulary he

has learned, we are reminded of the power of naming, of the liberation and self-assurance that follow from confident identification, and of the sense of personal empowerment effective language use confers on human beings.

Alina records the goals she has achieved: "concentrating on the activities we are doing, and having more friends." Students commonly set making friends as a goal and view it as a gateway to their academic achievement. The newer the students are to International, the more prominently the goal of friendship figures.

The personal statement essays of other students indicate that throughout the *Motion Program*, academic learning occurs within both personal and social contexts and takes on meaning through an increased sense of personal competency and interpersonal connectedness. As in the faculty evaluation system, conscious and reflective personal assessment in the context of a supportive but demanding community is the cornerstone to growth. While assessment is aimed at mutual learning rather than "catching" students' failings, the press for achievement and for constantly raising one's sights and standards is also obvious.

Natasha assesses her progress as she recalls how limited her initial response to the concept of motion was. At first, she thought motion meant "go." After some time in the program, her concept of motion expanded considerably:

> I learned a lot of new things and have many new ideas and insights about motion and movement. There are 21 people in our class, and everybody has personal ideas about this. Sonia* asked very philosophical question: "Is there life without motion?" I think no. Life is impossible without motion, it [*sic*] connected with motion. But, mechanical motion is possible without the life. Bullet from the rifle is in motion, but not alive. The end of movement means the end of life, but the end of life doesn't mean the end of motion.

Students articulate their achievement of personal goals, significant accomplishments, and what they have learned about working with others. They assess their progress in the areas of language growth, communication skills, individual and group work, task completion, reliability, and use of resources. Olga writes, "I am especially proud of my reading. I read the book which has 300 pages. It's my first book which I read in English." The personal statement essay of Sherif Baha el Din*, who is from Egypt ommunicates the significance of his learning English:

> Before I came to U.S.A., I didn't learn English so when I came here I had many troubles because I didn't know it. Now my English got better. On every subject I have to speak English because is some one who doesn't understand Arabic, so I speak and by doing this I'm improving my English skills.

Natasha, too, comments on her improvement in English as well as her increased appreciation for mathematical forms of communication and her increased confidence in

tackling challenging tasks:

> I can speak and what is most important -- to explain things carefully....The graphs are very important -- they are like a mirror, and sometime you don't need to read long and boring texts -- enough only to look at the graph and you'll understand the hole [*sic*] idea.
>
> Project Adventure helped me a lot. At first I very scared. I really trust people, but I still was scared. Then I conquered myself. I'm not saying that I don't afraid anything now, but I have learned how to get over of the scare and to try. And another thing in the Project Adventure you can see that many people, if they are together, can do lots of more than one person alone. And we solved many hard tasks, thinking logically about the strategy.

3. Mastery Statement. The mastery statement is a set of essays written by students to demonstrate the degree of mastery they have achieved over the concepts and skills presented in the course. A set of tasks laid out in the directions for the mastery statement guides students in demonstrating their capacity to synthesize their knowledge and critical-thinking skills in all four content areas and across all four content areas. They are asked to recontextualize, apply, and extend the knowledge they have acquired. A sampling of mastery statement tasks over various cycles of the *Motion Program* indicates how they loop students back to their work and learning during the cycle, encouraging them to use prior knowledge to make new connections:

- A scientist who studies fish goes to a small lake with a net. Describe a good procedure she might use to learn about the fish in the lake.
- Select the two most challenging elements on the ropes course [in Project Adventure]. Describe or draw the element. Describe your experience on this element. How did it help you learn trust, problem solving, and self-confidence?
- Consider Newton's three laws. State them in simple language. Give examples. What would a world which did not obey Newton's laws be like?
- How are the four classes of *Motion* connected? How are they different?
- What did you see in the movie, ***The Gold Rush***, that relates to what you have learned in physics, math, literature, and Project Adventure? Explain.
- In *To Build a Fire*, *Autobiography*, *Southbound on the Freeway*, *Being Moved*, *The Paw*, and *Graphing Lives*, you saw the concept of motion used in a variety of ways. Select two of these activities and describe in detail how a person or character can be in motion in ways that are physical and not physical.

- In several of the math activities we have drawn graphs and expressed the relationships in an algebraic equation (*The Mystery Container, Temperatures*). Draw a graph with a linear relationship between two variables. Write the equation for it. What do the y-intercept and the slope represent (for your variables)? (IHS et al., 1991).

Natasha's mastery statement, reproduced in Exhibit D, answers six questions concerning what she has learned: about writing; about connections between the work in math and physics and work in literature; about Newton's three laws; about distance, velocity, and acceleration; about linear equations; and about herself, through her work in Project Adventure. Her statement raises common themes that pervade the portfolios of other students as well. Most impressive is the clarity with which she can now explain what she understands about how to write, how to think through problems, and how to tackle new ideas by drawing on earlier learning. Her written explanations of Newton's laws and of the concepts of velocity and acceleration in free fall, further explicated with hand-drawn graphs and illustrations, demonstrate the kind of thinking and expression of mathematical reasoning urged by emerging professional standards in mathematics and science, as well as other disciplines.

Though Natasha's work is more clearly written than that of some of her classmates, it is not atypical of students' conceptual understanding. While Natasha illustrates Newton's second law with an example of herself and a friend pushing a box, first from opposing directions and then from the same direction, calculating net force and acceleration for each instance, Olga uses the example of a small boat pushing a larger boat. Yolanda Bermudez* creates illustrations to explain Newton's law of inertia. To underscore the principle that objects at rest tend to stay at rest, Yolanda draws a cartoon of a young boy swiping a tablecloth from the table, leaving the objects on it perfectly in place. The wide variety of examples described in students' portfolios reveals that they have made the connection, in various ways, between these abstract concepts and real-world events.

Students also use their knowledge of physics to inform their imagination when they conjure up a world without Newton's laws. David Han*, a Korean student, gives a typical answer:

> According to what I understand about Newton's 3 law, if there is a world which not obey the Newton's law, when you lean against the wall, you might fly away from the wall because the wall lean against you back more force than you lean on against the wall.

Similarly, students have thought hard about what they have learned in other areas. Natasha describes how the three parts of a written composition -- the introduction, the main body, and the conclusion -- help organize one's thoughts and convey one's ideas more effectively. Amina distills her newly learned writing skills into these personal principles of composition: "thinking about what to write before starting; concentrating on one theme;

writing clearly -- easy to understand; dividing the composition into paragraphs; using the punctuation symbols correctly."

Throughout mastery statement essays students also connect their experiences in Project Adventure to the development of trust and the interpersonal skills they use to work effectively in their academic groups.

4. Self-, Peer, and Faculty Evaluation. Portfolios and classwork are rated with grades ranging from A to NC by the students themselves, two peers, and two faculty members who have been selected by the student. Additionally, each evaluator comments on the student's portfolio, classwork, and interpersonal interactions focusing on areas of strength and recommendations for improvement. The student in turn writes a summary of the commentaries of his or her peers and teachers. Each of these commentaries, as well as the ratings, becomes part of the portfolio.

Although the evaluation procedure is systematic, it is personalized so that individual differences and needs are taken into account. In the evaluation of Rafael's portfolio, reviewers commented that they found working with Rafael pleasurable. They commended him on his progress in English and on the clarity, organization, and industry his portfolio demonstrated. One peer and one teacher directly but sensitively critiqued aspects of the portfolio for insufficient detail. Ruthellen Weiner, the teacher and an assistant principal at International, would have liked more details in the project. Rafael's peer reviewer underscored the differences between writing a lot, writing well, and writing that reveals the writer's inner life, alluding, as Weiner did, to the need for greater detail. Rafael's response summarizing their commentary indicated that he did not comprehend the distinctions made by his peer, which he ignored, and was unclear about what details he had omitted. He focused on the positive commentary of his teachers: "My teachers said I am organized and write well. I don't know what details that could be added." This ambiguity provided a basis for discussion at the conference.

The individual ratings for classwork and the portfolio assigned by the five evaluators are factored into one final letter grade at the conference. The final grade ranges from A to NC, since International has a no fail policy. Students who receive NC can fulfill the unmet requirements with other courses or re-enroll in the same course. The "Motion Evaluation Guidelines," which are distributed to students at the beginning of the program, clearly articulate teachers' expectations and the criteria that are used to judge student achievement.

Judgments in the two categories of classwork and portfolio entries are made on the basis of six indicators each. Indicators used to judge classwork are (1) number of absences and latenesses, (2) amount of work completed, (3) understanding of classwork, (4) working with others, (5) concentration, and (6) communication growth. Indicators used to judge the portfolio are (1) explains clearly and completely, (2) gives specific examples, (3) shows what the person has learned, (4) is well organized, (5) is neat and easy to read, and (6) explains the connection between classes.

The indicators were designed collaboratively by the faculty and the students. Interestingly, each group came up with the same criteria independently, except for "communication," which only the teachers thought of. On discussion, however, the students agreed that communication was an important criterion to include. Students also participated in developing the guidelines corresponding to the letter grades for classwork. To reinforce the value of collaboration as an important and necessary skill, the evaluation guidelines used in scoring the overall portfolio for the cycle place equal weight on "working with others" and "understanding of classwork." The student and his or her committee of peers and faculty comment on the extent to which the student supports and helps others and concentrates on his or her work, along with the extent to which the student has completed work adequately and can explain it to others. (See Exhibit E, "Evaluation Guidelines.")

Motion Program students come to understand and independently apply the standards in several contexts. First, standards are written in the portfolio, but effective communication of standards requires more than providing students with a list of terms and corresponding grades. Students must have opportunities to experience standards of performance. *Motion Program* students do this while they are working in different groups. Rugger explains, "They begin to notice what other people are doing and make their own distinctions." Ruthellen Weiner, assistant principal, elaborates, "They make distinctions when they are doing the first portfolio. They look at their work and the work of their peers. Going through the process [of assembling the portfolio and writing the personal evaluation, statement, and mastery essay] gives them a clearer idea of the standards."

But even the success of group interactions is insufficient for students to fully understand the standards for portfolios. Because students needed models demonstrating standards of excellence to fully comprehend what excellence looked like before they could achieve it, teachers assembled model portfolios with particularly insightful mastery and personal statements demonstrating standards of excellence. As students' access to the models and to one another's work increased, they developed an "I can do it attitude," says John Stevenson, LaGuardia Community College math professor.

Internalizing standards enables students both to achieve at higher levels and to be thoughtful evaluators. In addition to gaining a sense of standards, *Motion Program* students learn that self-assessment and peer assessment require fairness, which requires them to learn to resolve conflicts of trust and loyalty. Students have had to become conscious of these conflicts and learn strategies for negotiating them. Olga has learned that fairness is more than an attitude. She explains the effort required for students to develop the skills of being fair:

> How fair can we be about giving ourselves a grade? Through the whole *Motion* class, we try to develop the skill of being fair not just to ourselves but to others. We do it in the Project Adventure class -- develop the trust and being fair to yourself and to everybody else.

Luz Mercado*, a Puerto Rican student, elaborates on negotiating the fairness/loyalty conflict:

> Being honest about the grade is very important. When you do all the experiments with all groups, you learn how to be fair to everybody, especially if you have a friend in your group. Even if he did a C or a B portfolio, you have to give him a fair grade. *The most important thing is what you learn and what you experience* [italics added].

Natasha explains how structure, values and norms, and the socialization mechanisms in the class enforce fairness despite the tensions and internal conflicts prompted by the impulse toward self-advancement:

> It's very hard to grade yourself. You know how hard you were working and everyone else knows how hard you were working, if you did it last night or if you were working on it through the whole time we had. Everybody tries to be very fair for the grades for themselves. They know if they put a lower grade, then the teachers will think --because the teachers put a lot of trust in us -- then the teachers will think, "Well, I think that he did better, but if he thinks that he deserved a C or a B, let's put him a B." Then it makes you think, "Maybe I should get a higher grade." But then when you put an A for yourself, inside yourself, you know you deserve a C+ or B. Then your friends will come to you and say, "You know, I think you should try harder next time. But this time, I think that you don't deserve the A." *It's a very friendly atmosphere that makes you fair* [italics added].

The temptation to abuse adult trust is mediated by the knowledge of the community's values -- as Luz says, "The most important thing is what you learn and experience" -- and the power of the peer culture: the trusting atmosphere that students are unwilling to risk.

After the evaluations have been completed, the evaluation statements and grades provide the basis of the conversation for the final conference.

The Final Conference. After the portfolios have been evaluated, each student and his or her peer and faculty evaluators convene for a five- to eight-minute conference, the ostensible purpose of which is to determine a final grade. This is important for three reasons. First, the conference formally validates the student's achievement. Second, since students often do not know how their grades are determined, the conference is an opportunity to review the correspondence between performance, growth, achievement, and grade. Third, if the student and his or her evaluators disagree on their assessments, especially where students rate themselves higher than do their peers or teachers, the conference becomes an opportunity to clarify the rating criteria and process, the rating itself, and the rationale of each rater. The conference respects the perspective of the learner while adding other perspectives and a sense of external criteria as well.

The conference also has a forward-looking purpose, which is to set the course for future improvement, growth, progress, and commitment. The tone is hushed: sensitive and supportive, but serious. The student and his or her four judges sit around a table with the thick portfolio and its ratings in the center, attesting to the student's progress and achievement and available for public view and review. The center placement dignifies both the work and the worker.

Peer evaluators tend to comment primarily on the student's acquisition of English and behavior in group settings. Although according to custom they begin with complimentary statements of the student's strengths and contributions, they do not demur from criticism for students who "fooled around too much." Students being evaluated tend not to be defensive or resistant to the critiques. They seem to readily admit their errors, usually with reasonable explanations, not excuses. They show a clear-headed capacity to critique their own performance, as these conference comments reveal:

- "I really didn't do a good job on this."
- "I didn't maintain my momentum."
- "I didn't work hard at the beginning, but then I did and I think my work shows the difference."

Teachers take this opportunity to affirm the student's achievements and potential and to explore in depth with the student strategies that can improve performance. They ask questions intended to help students formulate new goals and the next steps to achieve them. Thus, plans for improvement are self-generated, emerging from students' own assessments of their needs and capabilities as stimulated by those of their teachers and colleagues. Once again, assessment is a tool for learning. Once again, the school's fundamental premise that assessment is linked to empowerment of students is reaffirmed. As an instrument of empowerment, the conference emerges as the *Motion Program's* ritual for the renewal of commitment: an individual's commitment to himself or herself and to his or her community and the community's commitment to the education of its members.

Because the system of assessment in the *Motion Program* is simultaneously a system of instruction that intricately and inextricably interweaves learning and assessment, they become as inseparable as the flip sides of a coin. Assessment and learning serve each other so dynamically in the *Motion Program* that students have an unusual capacity to reflect on, articulate, and utilize the "hidden" curriculum as well as the overt curriculum. As correction and self-correction become natural in the course of learning --teacher as well as student learning -- self-improvement becomes inevitable.

Interactions of Teaching, Learning, and Assessment

The principles and practices of assessment, identified in the three programs discussed above, have had far-reaching effects because they function as instruments of both learning and evaluation. They are integral to the daily life of classrooms in which assessment has become a habit of work rather than a special, feared, or surprising event. Because the teaching and learning process is laced with assessment, a feedback loop of teaching, learning, assessment, and validation has evolved, providing students and teachers with ongoing information about their performance, their work, and their outcomes. This approach provides all members of the school community with the systemic and personal capacity to obtain that information on a regular basis in either a private or a public forum.

By creating a system in which assessment is habitual and supportive, International increases the probability that students will be able to improve their personal competence throughout life because they have internalized a capacity for self-reflection, constructive interaction with others, and responsive problem solving. Stevenson explains: "We are always in interaction with the students so that the kinds of questions, the kinds of dialogue you may have with the students indicates to them how to think about the issues." Dialogue is both assessment and instruction in how to think about work, work problems, and work quality. Hirschy adds that these conversations with students inform teachers' practice. As teachers learn what and how students are thinking, says Hirschy, "they understand what is really being communicated." Consequently, changes in teachers' practices and changes in the portfolios have promoted further changes in student learning and performance. He says, "As the questions [in the portfolio] got better, the portfolios got better. Reading the portfolios is often a validation of what we're doing, and it gives us insights as to what they're really doing."

Evaluating student work from multiple perspectives is another form of validation for the members of this learning community. When evaluations by teachers and peers confirm students' assessments of themselves, the results can be very powerful, whether the grade is an A or a C. Students are frequently silenced by the unabashed admiration of their peers and teachers, who take great pleasure in describing their strengths and the details of their growth. Such attention makes students feel valued. Criticisms are delivered sensitively and within the context of both the students' potential and peers' and teachers' belief in that potential. Great pains are taken not to compromise the self-esteem of students whose self-evaluation is inconsistent with the evaluations by their peers and teachers. Time is taken to help students concretely and discreetly sort out the disparities and accept what is usually a lower grade than they have given themselves. The unspoken, but nevertheless palpable, refrain of these interactions is one of reaffirming shared commitment.

Effects on Teaching, Learning, and Student Performance

Information creates the possibility and the capacity for self-correction, without which learning outcomes cannot improve. Stevenson explains that in the *Motion Program*, "students

have the opportunity to figure out why they're not getting it. They can find the thing that causes them not to get it." The regular opportunities for formal and informal feedback among peers and faculty create an intimate and respectful learning community that can support students' admissions of "not getting it," their investigations of "why they're not getting it," and their uncoverings of "the thing that causes them not to get it." Luz explains: "You're not afraid to make mistakes in front of people you know. You express your ideas and then you sort them out. You're not afraid to tell someone else you think they are wrong. You feel free with one another."

WenFu emphasizes the significant role of intimacy in the clusters that keep students together all day with the same group of peers and teachers: "Because you are with the same kids every day, you get to know them well. You feel close." Through this process of socialization in a cushioned environment, a culture of inquiry and self-correction develops, making it safe for students to take responsibility for their outcomes. In fact, taking responsibility is the norm, as portfolio conference confessions reveal. This process paves the way for discovering *the thing that causes students to get it.*

Rugger explains that *Motion Program* students learn to assess themselves for the purposes of self-knowledge, self-correction, and self-direction. She underscores the connection between understanding one's thoughts and actions, and being able to change them, thus being able to grow; her remarks place in relief the difference between students' experiences with this form of assessment and the traditional form in which they "receive" a grade, but frequently do not understand it and are unable to use it to guide their future work and decisions. She says, "Students are always in the position of [looking at] where they've gone, what they're doing right then, and where they want to go." Natasha confirms Rugger's observation:

> First they are very scared and they go, "I'll never be able to write two pages in English of Personal Evaluation. I'm not good [at writing English] at all." Then once they started to write, they perform beautiful. And when we read it, the teacher goes, "Oh. you wrote here that you didn't make such a progress, but look here. You wrote two pages in English." People feel proud and that helps a lot.

Because the assessment processes encourage students to connect their past and present to their future -- to reflect regularly on their growth -- they increase students' faith in their capacity to grow and their willingness to take risks, especially when unfamiliar demands are made on them. As they take risks and grow, they gain confidence and a greater sense of control over their learning and progress. The connection between work and outcomes is demystified. Glassman observes that in *Beginnings*, because students confront their work on a daily basis, there are no surprises about grades.

Nancy Dunetz, career education coordinator, notices that students who have completed the *Motion Program* have the ability to think more deeply about problems than other students

are able to. The students themselves point with pride to the recent student government elections in which *Motion Program* students occupied 90 percent of the positions on the slates. Teachers notice changes in student performance: reductions in cutting, longer retention of information, and a repertoire of problem-solving and social skills.

The programs' assessment practices have changed teachers' roles, but not without anxiety. Teachers have had to learn to trust the group process in their classrooms and resist the impulse to overcontrol. Rugger writes about her own "odyssey" from a traditional teaching approach to a group-oriented, learner-centered style:

> About a year before I came to the International High School, I took the New York City Writing Project class, and was first introduced to the idea of group work for revision of writing. I loved the class because I was always active....In that way, I feel I have a strong bond with my students.
>
> I went back and tried writing groups with my classes some of the time. They would write, share their compositions, discuss revisions, rewrite....They wrote better, but it was noisy and not obviously under my control, which made me nervous.
>
> I then got the chance to apply for a teaching position at the International High School, and I was hired....What followed was the most stimulating and frightening teaching experience I ever had....For years I had been encouraged and required to be in total control of the classroom, and now I was in a school where the philosophy of education is to work in groups. I understood and applauded the reasoning behind this, but to put it into practice day after day was daunting. For one thing, there is often a lot of noise. People are talking to each other trying to explain. Sometimes this is going on in several languages at once. They may be arguing about points that are being made. At times, someone needs to get up to get supplies, or go across the room to get answers to questions. It appears to be confusion. People are not sitting in rows and whispering. I had visions of the principal or other teachers opening the door and asking "What's going on here?"
>
> But working in a class where the students speak five different languages, none of which I speak, and range from total nonspeakers of English to people who have been in this country for three years and have picked up a lot of English, made me realize that group work was the only system that would work. For one thing, I depended on my students. They had an area of expertise. They knew about their country and they knew their language. I needed them to help me....We depend on each other to share knowledge and experience, so we both learn. I had to give up my role of total expert, and realize we were learning things together (Rugger, 1990, pp. 36-38).

Nadelstern sees his role as one of continually rearranging and reshaping the organizational pieces so that teachers can explore the instructional initiatives that interest them. Contrary to the underlying assumptions of most schools, asserts Nadelstern, International is organized on the assumption that students and teachers are trustworthy.

A trusting environment is not, however, a laissez-faire environment. Teachers exert a strong classroom presence by becoming facilitators and coaches, casting off the role of disseminators of information. They have learned to demonstrate to students that they value more than the mere completion of activities. As a result, *Motion Program* teachers, for example, developed questions requiring students to apply their learning to new contexts. They learned to take the role of what Hirschy calls the "wizened guide." Rather than answer students' questions, teachers restate or recontextualize them and direct the group to resume their struggle in search of solutions. This response not only gives students a new handle on the problem, but models a strategy they can use whenever they get stuck. *Beginnings* teachers also see themselves as modeling the kinds of learning behavior they want for their students. As DeFazio and Glassman, who team teach, talk about modeling collaboration, DeFazio says, "It's a good model for the kids to see how we take different roles."

How Assessment Informs Curriculum

Assessment has prompted instructional and curricular changes in all three programs. Student feedback in *Beginnings* has led DeFazio and Glassman to reorganize the curriculum. They have refined some activities and added new ones. Revision based on student feedback, asserts Glassman, customizes curriculum to the developmental needs of students. As a result, the revisions increase students' capacity to produce increasingly sophisticated products and more in-depth analysis. This is corroborated by the *Motion Program* team. The more feedback the teachers receive on what students are and are not learning, the more they can target exactly what they want students to learn.

In all three programs, assessment has supported a shift in curriculum priorities from coverage of content to mastery of skills. That does not mean that rigorous, substantive, or traditional content has disappeared. Students in the *Motion Program* still do experiments in physics, generate algebraic equations, and read classic works of literature. Students in *Beginnings* study the American historical perspective on immigration. Students read and report on famous biographies in the *Personal and Career Development Program.*

In all of these cases, however, engagement with content functions in the service of developing essential skills and performance abilities. Content becomes a vehicle for students to develop intellectually, to demonstrate critical-thinking skills, to generalize, to recontextualize, to synthesize, and to apply their learning to new situations. Moreover, content offers opportunities for students to develop, practice, and perfect the life, study, and work skills that will make a difference in their success in postsecondary schools or the work place. They develop the skills of perseverance, task engagement, time management, prioritization, interpersonal relations, collaboration, communication, responsibility, reflection, and assessment.

Glassman says that students in *Beginnings* must learn strategies for presenting and giving feedback. He teaches his students presentation skills for their exhibitions. He teaches them to have a sense of pride during their exhibitions, to make sure that everyone is watching their presentations, and to take responsibility for engaging members of the audience who are not paying attention. He says:

> Everyone has a job. The presenter has a job of keeping everybody's attention, the listeners have the job of listening. If a kid's attention wanders during a presentation, the presenter must learn skills such as saying, 'How do you like this, Nancy?' Such skills are not learned in two shots or three or four. It's a long process. You do a little at a time.

The assessment used in all three programs has supported the development of interdisciplinary, theme-based curriculum that focuses students on the development and use of thinking skills rather than the mere memorization of content. *Motion Program* teachers report that as students progress, they spend less time on recapitulation, that is, redoing, neatening, or completing activities that they plan to include in the portfolio. They spend more time on the portfolio tasks that demand the reconceptualization and synthesis of their experiences across the curriculum and an analysis of their learning and growth.

Internship seminars demand that students engage in analysis of the work place from multiple perspectives: They assess their own performance at their sites, they assess their supervisors' assessments, and they assess the sites organizationally from the perspectives of benefits, worker satisfaction, and structure. This enables them to understand and appreciate many points of view and to reflect on the different criteria various parties bring to their assessments, tasks, or situations. In *Beginnings*, students' participation in peer assessment helps them learn to read critically and responsively and to develop internal criteria for judging what they read.

The practice of self- and peer assessment has demanded a new curriculum for communication and social interaction. Most traditional schools and classrooms are organized to avoid peer communication and social interaction, or at best to tightly control them. Almost all of the teaching, learning, and assessment in the programs we have described at International, however, take place through social interaction and collaboration. This is a particularly important prerequisite for the development of the generic, work-related skills of teamwork, cooperation, and interpersonal problem solving frequently cited by commissions and reformers striving to persuade schools to prepare students for their later life experiences.

Natasha explains that Project Adventure activities promote social-interaction skills. Because activities such as belaying[3] make students responsible for one another's safety and lives, they teach students to trust each other, despite temporary disputes and disagreements.

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[3] "Belaying is a technique used in rope climbing, involving concentration and focus on the person who is climbing.... The belayer maintains physical control of the rope. It is the belayer's responsibility to manipulate the rope to assist the climber, and to insure safety" (Allan Krull, 1990, "Project Adventure: An Adventure in Growth and Maturation," ***Insights***, p. 27).

She comments on the difficulty of remaining angry at someone when you literally have their life in your hands: "The responsibility puts things in a perspective." The belayed partner, as well, learns that trust can be a responsible choice that transcends disagreements and anger. WenFu concurs, explaining how Project Adventure activities develop communication skills that build trust:

> The teacher would give us a situation and a problem and time to think of a solution. Through this I think that a lot of us have learned about giving each other time to listen to their ideas. Learn to trust each other and we learn to listen to each other rather than to shout out. Through listening to other people, you might come up with better ideas instead of just your own ideas.

Fine describes how assessment becomes curriculum that teaches students to assume responsibility. In one of her *PCD* classes, she asked students to create a report card for which they had to develop evaluation criteria. They spent a week debating which criteria would be best, as Fine worried if she would ever get to the content. Once students settled on the evaluation criteria, however, the criteria began to drive their behavior as assessment often drives curriculum and teaching. Suddenly, students who cut class found themselves accountable, not to the teacher's rules, but to the rules of their peers -- and, worse yet, of themselves! Students were less likely to cut and more likely to exert effort in the ways suggested by the criteria they developed. Fine believes that the change in power relations liberated the students to take responsibility for their behavior.

Changes and Challenges

Because International was still a new school when it began its work on assessment, it has been spared the problems typically encountered by schools trying to reform long-standing traditions and behaviors. The only internal challenges have been initial student resistance and the need to invent the technology to implement the assessment. External stumbling blocks, including local and state policies that influence staffing and curriculum, are more problematic because they require changes outside the school's control.

New Roles and Responsibilities

The internal challenges have been met in the collaborative spirit that supports most activities in the school. When Fine's students resisted direct self-evaluation, she heeded Glassman's advice by introducing the album. Students took to assessment when it was embedded in concrete learning activities. She recalls:

> The biggest problem students had was viewing assessment experiences as learning opportunities, evaluating on a regular basis, asking, "Where was I and how far have I come?" [With the album] every single assignment is an evaluation of what's going on in their internship, what they're learning, and how they're doing.

Unless teachers help students negotiate their fear of the unknown, they are unlikely to accept new approaches. As DeFazio explains, the hardest thing is

> getting the kids to buy into the assessment, to see that there's a lot of value for themselves in it, that it will make them feel good to do it. Since they've never experienced it, they're scared of it, like all of us. But once you encourage them enough and create an atmosphere so they experience it, they feel great showing off their work.

Students also sometimes resist adopting new roles, especially active and interactive roles that release them from their powerless station in the school hierarchy where, traditionally, they have had no involvement in or recourse to their evaluations. "Getting kids to learn the skill of the process, how to look at something [i.e., the work of their peers] critically, how to offer helpful feedback, is a major problem," DeFazio notes. Learning the skills of the process, struggling for language, making the effort to communicate, are all symbolic of accepting a new role, a role that demands increased involvement, commitment, and responsibility from students. It is the foundation for reconfiguring the classroom community so that everyone is accountable to everyone else.

Standards without Standardization

One of the most exciting challenges International has confronted is the dilemma of standards. The issue of standards in the context of authentic assessment is controversial and complex. Here, the faculty's navigation through this barely charted territory has been thoughtful and provocative.

The *Motion Program* team confronted three issues: (1) the establishment of standards, (2) the communication of standards, and (3) the teaching of standards. Teachers brought a wealth of knowledge and experience about traditional standards from their former practices in other schools where they had taught tracked courses. But the instructional model the *Motion Program* team developed called for standards combining a collaborative learning process with a multifaceted product -- the portfolio. This is complicated. Hirschy explains:

> We have a multiple set of standards. Although it's very difficult to be exact about what constitutes an A, it's very clear to faculty and students when students fall in an A area or in a B area.... It's a composite of a group of individuals looking at a variety of areas and then putting together one picture.

The ambiguity is not indicative of confusion or sloppiness but of the team's desire to develop standards that capture the broadest range of achievement: achievement that is both conventionally and unconventionally demonstrated and that is social and personal as well as academic. The process is one of weighing and balancing various aspects of performance that are ultimately equally valuable for student development and success in later life. Rugger explains:

> An A student can generalize to something else, take knowledge and use it someplace -- in written form, in art work, in the physics lab. There are students who can do this less well, but their leadership skills help others to reach that A level and everyone acknowledges that.... They may be in the B+ range as far as the ability to generalize. But they are a powerful force in the class. And they can get an A. They may be able to verbalize their generalizations better than writing them.

International teacher Simon Cohen has articulated some of the various factors that he has found important to consider in his quest to "assist younger people to go as far toward realizing their potential as I could in the time they were with me, an older professional" (1990, p. 30). These reflect the questions teachers at International wrestle with consciously and intentionally on an ongoing basis:

1. How do we balance various factors, for example, homework, classwork, attendance, punctuality, group work, individual work, and so forth?

2. How much do we credit students' growth in a subject, and how much their mastery of the material?

3. How much credit can we give for language development, and how much should we give for content acquisition?

4. How much do we take a student's individuality and uniqueness into account, and how much do we hold the student to a set of standard expectations?

5. How much do we credit affective and behavioral aspects and how much do we credit cognitive growth? (Cohen, 1990, p. 31).

Cohen posits that the appropriate weight for each of these factors may shift over time for individual students. Behavioral concerns may weigh more heavily at the beginning of a student's experience, and cognitive concerns may weigh more heavily at the end; it may be critical to emphasize and reward language acquisition initially, with content acquisition gaining in importance later on.

In this spirit, the *Motion Program* team acknowledges the importance of both academic and social standards as well as the salience of both personal and group standards. It has acknowledged the value of collaboration, interpersonal relations, and communication as being as powerful as academic achievement itself. While this equation is unorthodox in secondary schools, it is common in the work place, where interpersonal skills that increase and improve productivity are highly valued and rewarded. In redefining standards, the *Motion Program* team has raised the question of what knowledge is of most worth in schools.

Hirschy explains that the multiple-perspective evaluation system produces multiple sets of standards against which individuals assess their progress and achievement. This helps maintain multidimensional standards. In the *Motion Program* assessment system, internal

standards are applied in the self-evaluation, group standards are applied in the peer evaluation, and broader societal standards are applied in the faculty evaluation. Actually, these multiple sets of standards exist in all classrooms, but, except for the teacher's standards, they generally remain hidden, unacknowledged, and without voice. This contributes to many students' reasons for opting out of the formal system, feeling it does not value what they deem important.

Through the *Motion Program* assessment process, these multiple sets of standards become visible and public. They influence one another. They are discussed, negotiated, and revised as students have access to them and to one another's achievements and strategies for achieving. The standards are also inevitably raised and enriched as students interact and engage their peers and teachers, as teachers see a wider range of possibilities, and as they develop the teaching technology to obtain improved student outcomes. For example, when students in Hirschy's physics class independently extended their learning to invent activities, he included some in the physics curriculum. This action acknowledged the role of students as legitimate curriculum developers. Hirschy's discovery that students demonstrated their mastery of content by generating their own activities led him and his colleagues to expand the indicators of student expertise, thereby both increasing the level of challenge in the program and increasing students' opportunities to demonstrate their expertise. They revised the *Motion Program* curriculum to include a student-invented activity -- the special project -- that teaches concepts of the course. In the *Motion Program*, student outcomes are not the culmination of the learning experience; instead they become a starting point for new learning opportunities, as their products feed back into curriculum and instruction.

If standards are not immutable, how are continuity and constancy maintained? Teachers continually check their consensus on standards by analyzing the degree to which their evaluations of students' classwork and portfolios are compatible. This process guides the continuous construction of standards by students and teachers, which, asserts Rugger, "is the only way to take the cap off achievement." Ultimately, the validity of such a system rests in the knowledge and expertise of the teachers overseeing it. Having seen the process in action as well as the products of students' work, it is easy to believe the observation of Dunetz: "Over the years, teachers' standards have become higher and higher and kids' products better and better."

Supportive Policies

At the heart of International's integrated teaching, learning, and assessment system is its creative and energetic faculty. Here too, International has had the good fortune to be able to seek and hire like-minded teachers on the basis of their qualifications and commitment to the school's educational mission and innovative practices. International is one of only two schools out of over 900 in New York City that has been granted a much valued waiver from citywide personnel policies that authorize the central office to randomly assign teachers to schools and permit senior teachers to automatically transfer throughout the city wherever there is a vacancy in their license area. But the waiver must be requested anew each year, and, since there are no guarantees that it will be granted, International's control over its destiny is uncertain.

An additional challenge is a continuing constraint on the shape of the curriculum. As the school seeks to go further in the direction of an interdisciplinary curriculum organized around active, collaborative learning, the New York State Regents Competency Tests (RCTs), particularly those in content areas (e.g., social studies and science), increasingly "get in the way," accordingly to Nadelstern. Still grounded in an outmoded theory of learning emphasizing the memorization of disconnected facts and employing an outmoded form of testing using primarily multiple-choice exercises, the RCTs grate against integrated, project- and activity-based curricula that are seeking to get students to think in greater depth and perform in more complex ways.

Though students at International succeed on the Regents tests, the tests deflect time and attention away from what the school sees as more important kinds of learning activities. International faculty look forward to a day when the state's approach to assessment supports the kind of successful teaching and learning they have developed. Recent initiatives by the state's Council on Curriculum and Assessment promise to place assessment systems like those at International and Central Park East Secondary School at the forefront of statewide changes that are transforming testing and the goals of teaching (NY State Council, 1993). In the new system, local schools and districts will develop portfolios of student work supported by state performance assessments and an assessment bank providing access to models and exemplars.

Conclusion

The assessment practices at International make school a work place where the processes and the products of individual and collaborative student work are at the center of the entire enterprise. Students learn a work ethic founded on effort, pride in one's achievements, acknowledgment of mastery and expertise, and a capacity to accurately and adequately assess what they have done and how it can be continually improved. The expectation is that all students will ask themselves if they are working up to their potential. The teachers want students to develop and internalize the drive to achieve their potential.

There is no division at International between academic and vocational skills. Critical thinking, goal setting, accurate self-assessment, effective communication, relationships with peers and supervisors, collegial collaboration, self-motivation and initiative, and application of learning to new contexts -- all features of the assessments -- are valuable in both the school and the work place. Teachers report that students' growth demonstrated by higher levels of cognitive skills, greater capacity to retain and generalize what they know, increased self-reliance, and a repertoire of problem-solving strategies and social skills. They possess self-knowledge about their capacity, potential, and effort.

In contrast with traditional assessments, in which the test is an abstract proxy for actual work, at International the test *is* the work, whether the work is an activity, a product, or a portfolio. Despite the fact that the artifacts of authentic assessment require more intense and demanding work, whether they are portfolios or products such as the internship album or the *Beginnings*' autobiography, students prefer them to traditional tests. Glassman is fond of pointing out that no student has ever lost his or her autobiography. According to Natasha, the

process of assembling and organizing portfolios encourages students to construct knowledge and respects them as learners because it reflects their achievements in their own terms:

> Portfolio is important because you build, you put everything together, all your experiences during the cycle in the class....You look at the work and you are able to see what you did and how you did it. When you do the tests [a reference to traditional tests], you study, you learn by heart, next day you pass the test, that's it -- out of your head. You will forget about it. I guarantee.

Olga concurs that portfolios are better than tests, illustrating how they double as learning opportunities:

> Portfolios are better than tests. Even if you cannot do something in portfolio, you ask someone for help, you ask for explanation, and you still put it in your own words, you're still writing it yourself. Even if you didn't learn it before, you are learning it while you are writing it. Once you present it [at debriefings or before the class], you know it for sure. It's forever.

But is the assessment at International forever? Without policies that support it, does it have a chance to become the norm rather than the exception to the rule? Will there be a time when International cannot obtain the waivers necessary to carry on its work? Now that International has a $600,000 federal Academic Excellence Award grant for the purpose of replication, will other schools have to traverse an obstacle course of regulations in order to replicate its success? Will other schools, inclined to adapt International's practices but with leaders and faculty who are less resourceful, less resolved, or less lucky than Nadelstern and his teachers, be willing and able to change without policy supports in place? These are the $64 million questions that school reformers must ask -- and answer -- in order for International's accomplishments to become a foundation for their own and other schools' further growth and success.

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Exhibit A

From: Natasha To: Alina*

The letter N1

I want to tell you about the book what I'm reading know [*sic*]. This book is written by Paul Zindel. I never read his books befor, [*sic*] & it was interesting to open a new writer for yourself. I don't knows exactly, but I think, that this book is about Polish students in America, the only thing, because I think so, that there are many Polish names, may be the author is Polish too. As I said, this book is about students, seniors, which are going to graduate nearly a month. About their relationship. I read a most part of the book, but in this letter I'll tell you only about few chapters.
There are friends Liz & Maggie. Liz is effective, beautiful girl. with strong character. All boys like her & she has a good boy friend, who's [*sic*] name -- Sean. They love each other, & till last time everything is going well. Sean has a car, & they often go to the beach -- there -- theire [*sic*] favorite place. They both want to have sex with each other, but they understand that this is impossible. Liz has problems with her parents. Her father died, & she has stepfather, who is dominate on her mother, so the atmosphere in the house is heavy.

Maggie is a nice, good girl, but Liz -- a leader in their friendship. Liz's boyfriend acquainted Maggie with his friend, Dennis.

I think, that's it. Now I want to ask you, how do you like your book, what do you think about main characters? I'll wait for your letter. Bye-bye. Natasha.

The letter N. 1

for: Natasha
Alina

Dear Natasha!

In the beginning of my letter to you I would to wish you happy New Year.

I want to tell you about my book, which I read in the last Chrystman [*sic*] vacation. I chose very interesting novel. The title of this book is "Lisa, bright and dark." This book is written by John Neufeld. This novel is tolking [*sic*] about a hard life of the young girl named -- Lisa Shiling. The narrator of this book is Lisa's girlfriend Betsy Goodman.

I read just firsts [*sic*] four chapetrs, but this is very tempting beginning. In the beginning, Betsy is talking more about her friends, which have connections with Lisa. So these are Lisa's boyfriend -- Brian and her two girlfriends -- Mary and Elizabeth. They was from the same school, from eleventh grade.

Lisa, the first hero of this story had a big problem with herself. She went to crazy. The parsonts [*sic*] don't heard their daughter.

Lisa was beautiful girl. She had great style, full figure and fantastic legs. She had also a mean sense of humor and big imagination.

Her friends notice her problem on the party in Mary's house. This was day when Lisa and Brian celebrated their first anniversary. Her behavior was different. The party was great and she had good humor. But in one moment she was very nervous and she made a scene for Brian. Then she was like before. Betsy interested her friend. I thing [*sic*] she want to help her. I'm very interesting what will be next. I like stories like "Lisa bright and dark." If you like stories like this, you must read this story. Please, write what you thing [*sic*] about my book and about my letter.

Keep smiling!

Alina

Hello Natasha!

I would to give you my opinion about your letter.

Your letter was very nice. You wrote very interesting about your choice book. I like stories, which are tolking [*sic*] about young people. I'm so happy because your story is tolking [*sic*] about Polish students.

Maybe when I finish my book, I chosen a book what you read now.

Alina

Exhibit B

MY AUTOBIOGRAPHY (decision).

My name is .... and I'm 14 years old. i come from Atlantico-Colombia. Atlantico is a state, but I lived in the city of Barranquilla. I lived in Barranquilla all my life and I lived in a city with my mother, sisters, cousins, uncles, aunts, and grandparents.

One of my big decisions is when I had to move from Colombia to the United States. It was a big, big decision that I had to make because I didn't want to leave my family and my friends. My family is to big and I love and Ilove them all and my friends. I had a lot of friends in the school, neighborhood, in the town where my grandmother was born in other cities. miss those people that I left in my country because where I lived everybody is so friendly, and it is so beautiful.

But I had to move to this country because my Dad was here (New York) and he wanted to be with us. He wanted me and my sister studying here and he needed to be with us because he could see us only in December and he didn't want to form a family like that. Someday I want to move again to my country because Imiss all my friends and family. This decision was hard for me because I had to change my life because now I can't have my family with me, and I lost my friends. Also, there is a big difference in the languages. English and Spanish are so different and it's difficult to learn another language. In this country everybody needs to speak in English. Other differences are the food, customs, education and the people.

My parents like my country too, but we have everything here and now it's difficult to move again. "It's another life, another world." I feel strange in this country.

!This decision changed my life!.

Reading Log #8

My book, which I hope to finish soon, has three parts. It's three months of Summer.— June, July and August. I read 90 pages more and now I already finished one of these part. It's June. In this time the meetings Angie and Jack were restricted only seeing of movies and rides in Jack's car. They never talked about their feelings to each other, but we can observe thoughts and feelings which Angie feel with respect to Jack

Now we can talk a little about Angie's character. She is very interesting girl with very rich inner world. She is very kind and knoledgable. She is a girl from one kind of group who went to school and was hearty ? ? in stading She never had boy friend before, maybe that's why sometimes Angie look very naive, but she is an understanding comprehension and sincere girl. Now we know a little about Angie.

Good description

Now I'd like to talk about feelings like continuation of my conversation in other logs. It was in one night near

the end of June, when she and Jack walked along in the streets

I guess this explains what happens as people get older & more confident about being on their own.

"... It was then that I realized how much older. I felt when I was away from my family. It wasn't that I felt taller and or fatter but just more important. They cared about what I thought, of course, but in a different way ... when I was away from them it was different ... -at home you are just part of family, but away from them you really are somebody!"

May be this thing is inevitable, but a lot of girls make this thing more lack of understanding their family. They start to feel more freedom out of home A big problem is when parents don't understand their children, but of course many times children don't want to listen their parents. Parents and Children have different points of view, but when parents and children are friends, when they respect and trust to each other this problem disappears. But of course if child goes out very often, and doesn't listen

55

his parents, he doesn't respect adult, it is big mistake his parents and in his upbringing
This is the problem, ~~what about~~ I wanted to tell you about-

Your logs are always thoughtful. I learn more about the experience of being a teenager. You read well - because you use literature to deepen your understanding of life.

Temperatures

Date Completed: 11/20

Title: Temperatures

Purpose:

The purpose of this activity is to look at the relationship of the Fahrenheit (°F) temperature scale and the Celcius (°C) temperature scale. The thermometers which you will use measure *temperature*. If you can not explain to each other what temperature means, you should consult your textbook or discuss this with an instructor.

Equipment:

Celcius thermometer
Fahrenheit thermometer.

Procedure:

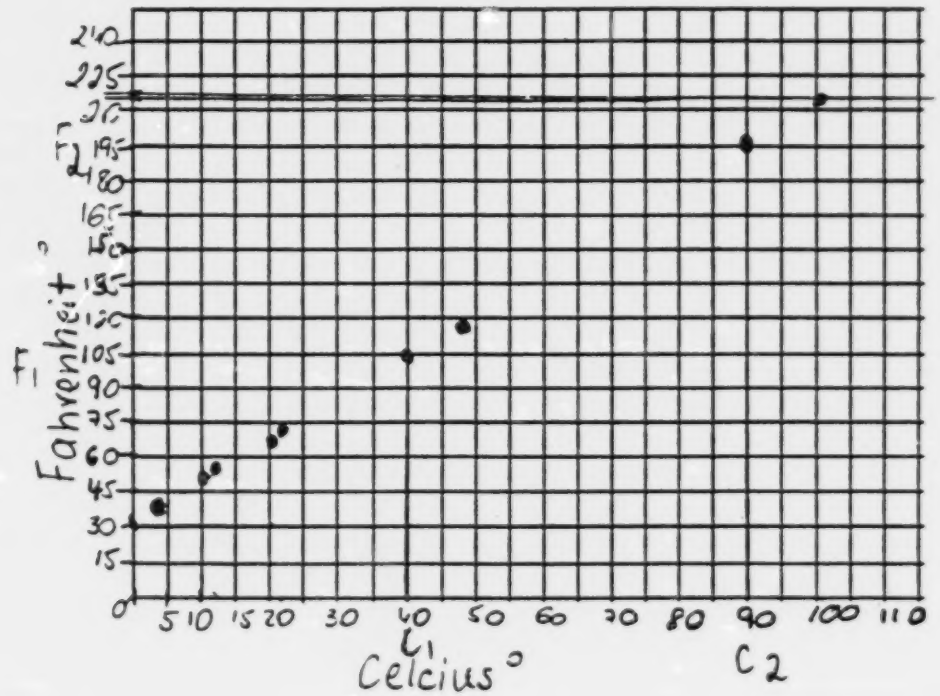
You will record the temperatures of various situations and places around the school using both the Celcius and Fahrenheit thermometers. Each situation or place will give you two numbers, the Celcius temperature and the Fahrenheit temperature. After plotting these pairs of numbers on coordinate axes in various ways, you should then be able to explain the relationship between the two scales.

Record the temperatures in a variety of places or situations: outside air temperature, classroom temperature, office temperature, temperature on different floors, water fountain water temperature, bathroom hot water temperature, cafeteria refrigerator temperature, and so forth. These are just suggestions. Feel free to add your own. Have fun.

Measure the temperatures of at least seven situations or places and record the data below. You will need to refer to this data many times so be as accurate as possible.

Situation or Place	Temperature ° Celcius	Temp. ° Farenheit
1. Air temperature	22°C	74°F
2. Table top	21°C	72°F
3. Refrigerator	10°C	50°F
4. Hot (bathrooms)	48°C	118°F
5. Boiling water	101°C	216°F
6. Ice (water	3°C	40°F
7. Cold bathroom w.	12°C	56°F
8. Outside temperature	4°C	43°F

Plot the data points on a grid where the horizontal axis is Celcius temperature and the vertical axis is the Fahrenhiet temperature.



Describe the graph.

The line in this graph is straight, what means that the relationship between Celcius and Fahrenheit is constant.

The relationship between Celcius and Fahrenheit temperatures is *linear*. If your data does not confirm this, see your instructor.

Find the slope of the line.

The slope is 1.80.

Where does the line cross the vertical axis (the y-intercept)?

The line crosses the vertical axis on 33°F

What Fahrenheit temperature corresponds to 0° Celcius, the freezing point of water?

30°F corresponds to 0°C.

What Fahrenheit temperature corresponds to 100° Celcius, the boiling point of water?

215° corresponds to 100°C.

How could you convert any Celcius temperature to Fahrenheit?

We can convert the Celcius temperature to Fahrenheit by using a graph. We look at the horizontal axis, which represents Celcius degrees and then we go up to the degree that Fahrenheit will represent

Write a mathematical expression or equation for this conversion. If this step is not clear for you, get some assistance before continuing.

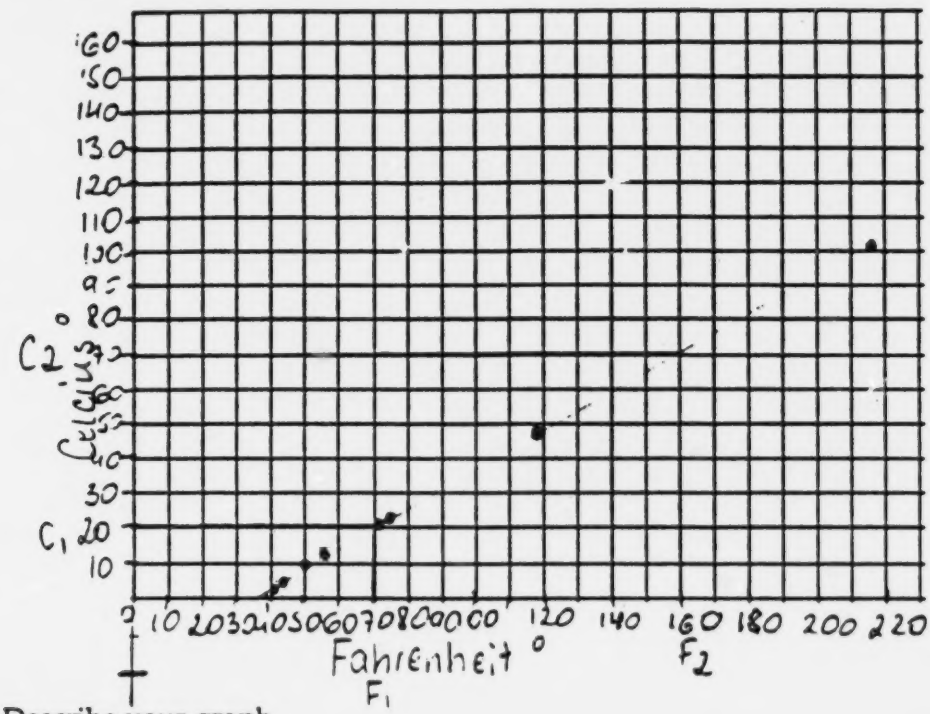
$F° = \left(\frac{9}{5} \times C\right) + 32$

for example: $\left(\frac{9}{5} \times 100\right) + 32 = 212°F$

$F° = M_C + b$

$F° = 18°C + 30°$

Now plot the data points with Fahrenheit on the horizontal axis and the Celcius temperatures on the vertical axis.



Describe your graph.

The line in this graph is straight, what means that the relationships between Celcius and Fahrenheit is linear - constant.

What is the slope of the line?

The slope of the line is .56.

What is the y-intercept?

The y-intercept is -19

What Celcius temperature corresponds to 32° F, the freezing point of water?

0°C caresponds to 32°F

What Celcius temperature corresponds to 212° F, the boiling point of water?

100°C corresponds to 212°F

What is the slope of the line for converting Celcius to Fahrenheit? (The first graph) The slope of this line is 1.80.

What is the slope of the line for converting Fahrenheit to Celcius? (The second graph) The slope of this line is 0.56.

What is the product of the two slopes?

The product of the two slopes is 1.008

The place where a line crosses the vertical axis is called the y - intercept. Is there a numerical relationship between the two intercepts?

Write an equation for converting Fahrenheit to Celcius?

$212 - 32 \times \frac{5}{9} = 100°C$

Take the temperature in the room now. Convert this temperature to the other scale. Now convert back. Describe your method and show your work below. (Note: There are two ways to do this, using the graphs and using your equations.)

21°C

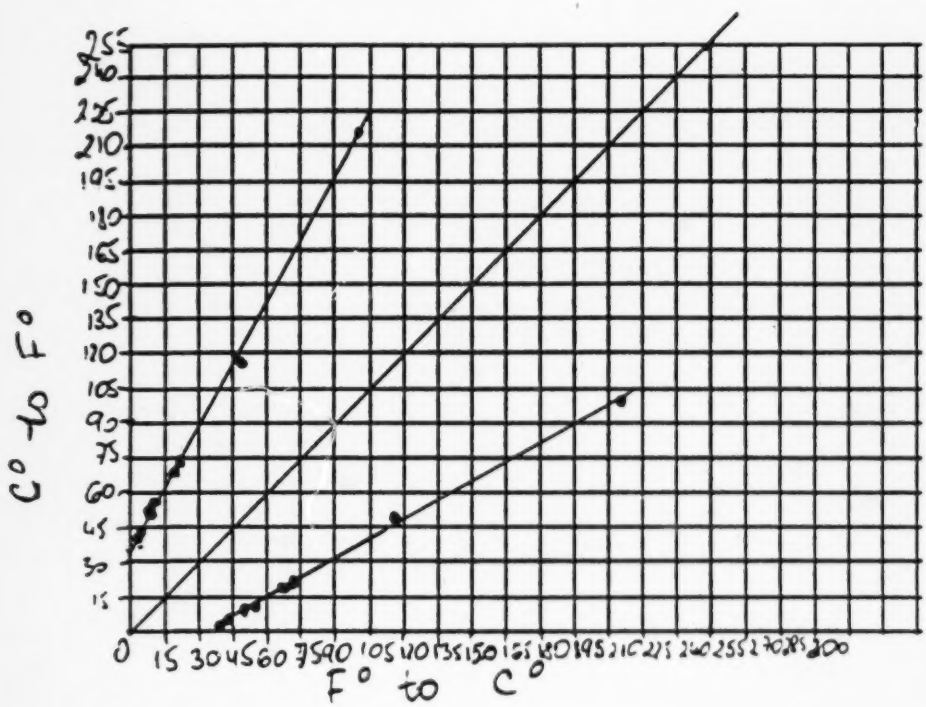
$F° = 1.8C \times 21 + 33 = 1.8 \times 21 + 33 = 70.8$

$C° = 1.8C \times 70.8 + (-191 - 0.6 \times 70.8 - 19 = 23.5.$

What happens? Explain.

The temperature changes.

Now graph both lines on a grid where both of the axis will share the same numbers. It is just as if you placed the second graph over the first one. One line will represent °C to °F, and the other °F to °C.



What relationship do you see? You may want to lightly sketch in the line through the origin which divides the first quadrant into two congruent parts.

The relationship between them is that they are like a reflection of each other.

In general,

$$°F = 9/5(°C) + 32.$$

Can you solve for °C in terms of °F?

$$C^0 = \frac{5}{9} \times (F°) - 32$$

Try placing or substituting one equation into the other, what happens?

The numbers change.

Statis-ticks and Common Cents

Name: C.
Partners: ---

Date Completed: 5/14

Purpose:

To explore the patterns of the distributions of two common occurrences.

Equipment:

graph paper (optional)
pennies (6)
calculator (optional)

Procedure:

A tick is a small insect that lives on a host animal. Normally these animals have fur or some form of hair. Some common animals that ticks live on are deer, rabbits, mice, monkeys,... and people. Ticks can transmit diseases from their hosts to people, diseases like Rocky Mountain Spotted Fever and Lyme Disease. It is important in controlling the spread of such diseases to know something about the tick ***population***, the number of ticks, in a particular region of the country.

Naturally we cannot count all the ticks. But the number is important. Fewer ticks on a host may mean the region is safer. More may mean we need to resort to using insecticides. So we choose a SAMPLE of all the host animals and count the number of ticks on the sample. Eighty deer from an area around Malverne, New York were selected. The number of ticks on these deer is given below:

14-16

25	24	10	24	30	25	42	28	(14)	19
30	26	22	31	11	(15)	33	21	(16)	35
22	25	(16)	26	35	22	22	21	35	22
27	24	21	35	30	25	25	26	27	27
22	24	30	29	43	35	22	(17)	25	31
(14)	25	30	35	(16)	(15)	35	35	24	19
(15)	27	39	(16)	22	22	29	26	22	24
26	31	26	24	(14)	10	25	30	24	36

Ticks

If 9 - 13 ticks/host is the first *class* we consider, how many classes of the same size would we need to include all of the 80 deer?

- There are 7 classes of the same size would we need to include all of the 80 deer.

How many deer carried between 9 and 13 ticks? This is the *frequency* of the class 9 - 13.

There are 3 deers carried between 9 and 13 ticks.

What would the other classes and their frequencies be? Complete the following table.

Class (# of ticks)	Frequency (# deer)	
9-13	3 ✓	
14-18	11 ✓	
19-23	15 ✓	
24-28	28 ✓	55/80 ~ 69%
29-33	12 ✓	
34-38	9 ✓	
39-43	2 ✓	
	80	

In which class would the average (or MEAN) be? Can you estimate it?

The average would be in class 24-28, and I can estimate it, because the class 24-28 had the largest population among the 80 deers in 7 classes.

If you have a calculator, what is the exact mean (average)? Describe how you got the exact mean (average).

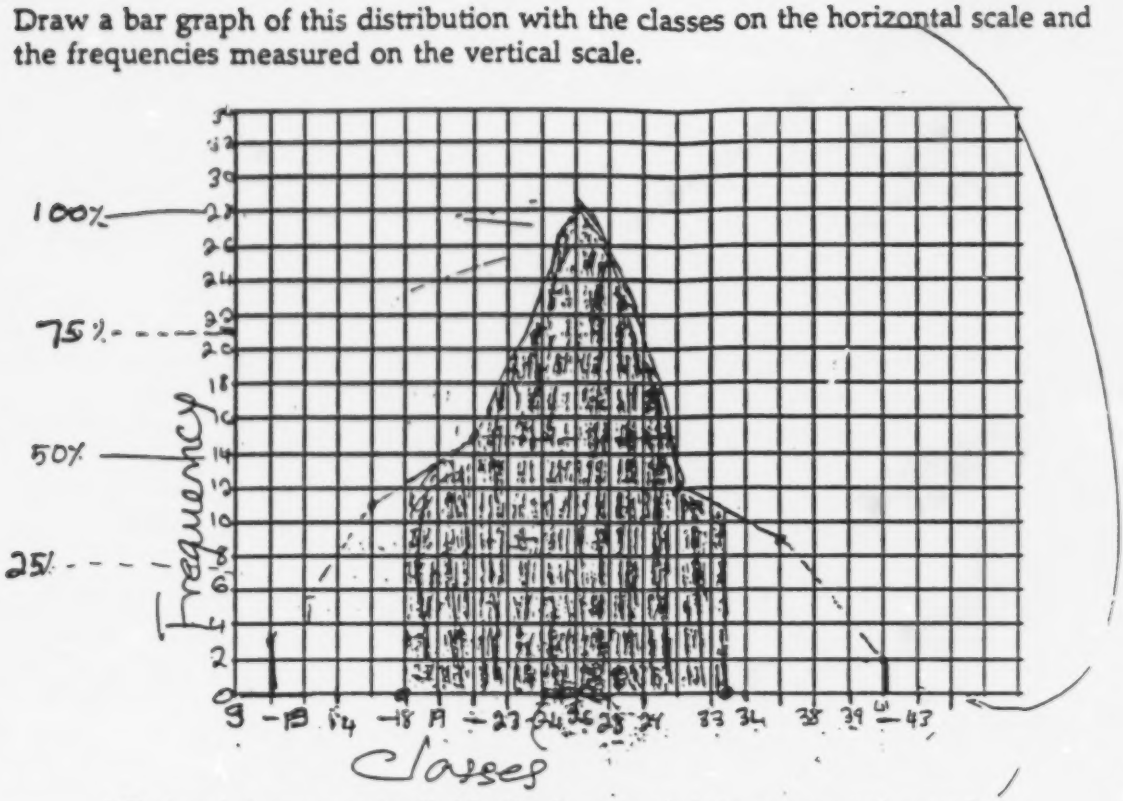
2008 / 80 = 25.1 The exact mean or average is 25.1. I got the exact mean by take all the number of ticks on the 80 deers add together and divided by the 80 deers.

This means the average # of ticks per deer.

Can you think of a distribution where the mean is not in one of the center classes?

Yes, I can think of a distribution where the mean is not in one of the center classes by the graph.

Draw a bar graph of this distribution with the classes on the horizontal scale and the frequencies measured on the vertical scale.



What point appears to divide the bar graph into two equal areas?

26 appears to divide the bar graph into two equal area.

* - How does this value compare with the mean? Does this suggest a way to estimate the mean from the bar graph? Yes, The value compare with the mean is very close. Yes, I estimate the mean for the bar graph by look for the point that divide the graph into two equal part.

What points cut off the middle 70% of the total area of the bar graph? How did you find the points?

18 – 34

how many item of data are between 18 ticks & 34 ticks (51)

$51/80 = 64\%$

Estimate

If there are 750,000 deer in Malverne, what is the tick population on these deer? The population of the tick is 18,750

$750{,}000 \times 25 = 1{,}875{,}000$ ticks

$\frac{80}{2008} = \frac{750{,}000}{x}$ $80x = 1{,}506{,}000$ $x = 18{,}825$

How many deer carry fewer than 13 ticks?

$\frac{750{,}000}{80} = 9375$ $9375 \times 3 = 28125$

How many carry more than 34?

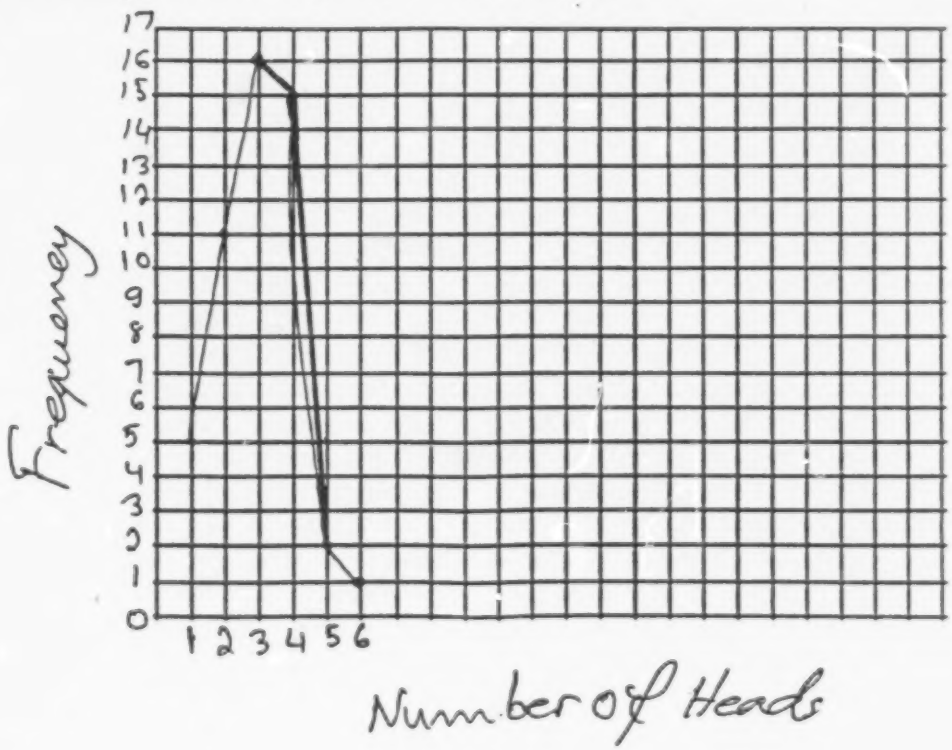
103125 $\left(\frac{750000}{80}\right) \times (11) = 103125$

Common Cents:

Take 6 pennies, shake them well, and toss them on the table. Note the number of heads you see. Repeat this 50 times. Noting that the number of heads you can get is 0, 1, 2, 3, 4, 5, or 6, complete the following table:

Number of Heads	*Frequency*
1	𝍸 |||| -5
2	𝍸 𝍸 ||| -13
3	𝍸 𝍸 𝍸 𝍸 || -16
4	𝍸 𝍸 𝍸 |||| -15
5	|| - 2
6	| - 1

Make a bar graph of this distribution with the number of heads on the horizontal scale and the frequency on the vertical scale



The *probability* of an event is its frequency divided by the total number of trials, in this case f/50. What are the probabilities of the number of heads possible in this experiment?

Number of Heads	*Probability*
1 5/50	0.10
2 11/50	0.22
3 16/50	0.32
4 17/50	0.33
5 2/50	0.04
6 1/50	0.02

What is the sum of these probabilities?

1 ✓

What is the probability of getting exactly 3 heads?

0.32 ✓

What is the probability of getting more than 3 heads?

0.36 ✓

What is the mean number of heads?

0.16

Discuss the similarities and differences of the distribution of the ticks and the distribution of the pennies.

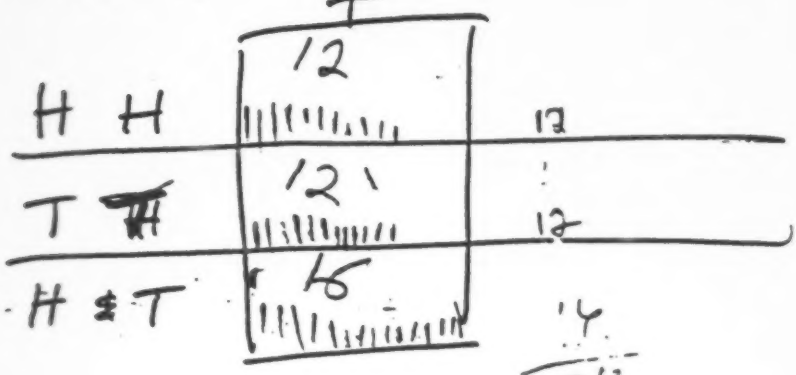
16 14
+2 ×4
18 5

.10
.22
.32
.30
.04
.02
1.00

1 6
6 1.00
6
40

There are ways to calculate the above probabilities theoretically, without relying on experimental data. If you would like to learn about these see an instructor about doing a special project.

flipping 2 coins 50 +



Color

6/64 = 1

2.2.2.2.2.2 = 64

2

2

12

3

T T

H H

T T

T T T
H H H
T H T
H H T

2.2.2 = 8

1 2T 1/4

2 TH. 2/4

1 2H 1/4

T T H
H T

3.2.1

H H
H T

72

69

Exhibit D

Mastery Statement

1. What have I learned about how to write well from your writing experiences in literature?

I have learned about it a lot of things. First when we begin to write we have to know about what problem to write. Then make plane. Most of us I think know that almost every work like Reading Log has three parts: introduction which says about what are you going to write, next is the main part which talk about problem more extensionly, this part reveal introduction and the last part it is usual some conclution from everything what did you say before, or your own opinion or thoughts about work problem. If you use it, I mean these three parts when you write something it make your work better. Plan can halp you to make order in your thoughts and of course

in your work. Also what I have learned about how to write well, I can say that you have to write as easier as you can. It make your work more understanding for you and for your readers.

2. How does the work you have done in Literature connect to the work in math and physics? Give examples from at least two of the activities you have done since mid-sycle.

The four activities I have done which was real cometted literature with other subject. The Paw, what is scienes, Alice in Wonder-land, and South-bound on the Freeway. How it comected? When we do some activity we answer a lot of questions, some of them is about physics and moth. For example „The Paw" is activity about measorment which we used in math in activity „My Ruler". „Alice in Wonderland" we after reading we talked about falling and we had to give our knowledge of physics about fall, to support this answer we used information in physics and in math also. In activity „Southbound on the freeway we talked about mistake

like we can make similiar in math in „Statis-sticks". The connecting Literature and physics and math is very easy, we use our knowledge which we get in physics and math to explain something in literature. But this connecting is very important, and the idia of „motion" make us more connecting everything, connecting different topics and combine different knowledge.

3. Consider Newton's laws. Play with them in your mind. State them in simple language. Give exampes. What would a world which did not obey Newton's laws be like?

Newton's 1st law in own words:
When somebody rests or moves with constant velocity and some force acts on it, this object will start to move or accelerate or this force will compel the object to move slower to state of rest. In another words, is after acting some force object changes its position.

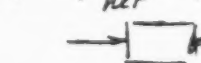
Examples:
You run and somebody push you opposite why to your own direction you can't

stop suddenly, but in a few seconds you'll stop running. It means that some force (in situation is pushing force acted on you and you changed your stats of motion. Another thing if you set somewhere and somebody pull you or push you, you start to move or if you moved already you accelarat.

Newton's 2nd law in own words when some object has acceleration it produced by a net force which is resulting force, and acceleration directly proportional to magnitud of this force which act with the same diraction as a net force and inversely proportional to the mass of the body

$a \sim F \quad a \sim \frac{1}{m} \quad a = \frac{F}{m}$

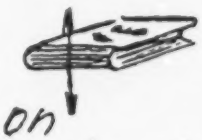
Examples:

Me and my friend we try to push the big box together but she push with one force for example $F_{her} = 10N$ and $F_{my} = 13N$ $m_{box} = 3000gr = 3gr$  the net force it'll be equal $13-10 = 3N$, the accelaration which will be produced by this net force it will equal $a = \frac{3N}{3kg} = 1\frac{N}{kg} = 1\frac{m\,kg}{kg\,s^2} = 1\frac{m}{s^2}$. And if we together try to pull it with one diraction it produced more accelaration $a = \frac{13+10}{3} = 7.7\ m/s^2$ From this examples we can see that if the net

force increase and mass is the same, acceleration increase too.

Newton's 3rd law in own words. For every force exist another force which exerts opposit diraction and equal to the first force. Action force equal reaction.

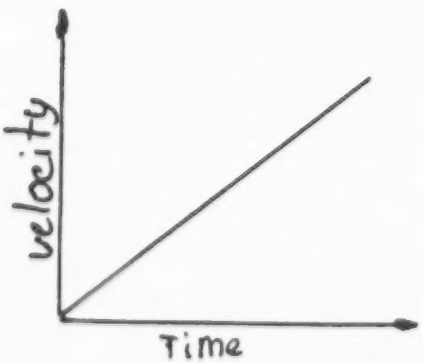
Examples:



The book lay on the table it doesn't move, but book act on the tabe. If the book has states of rest it means some equal force act on the book, and in this situation the table act on the book.

I think that without these laws everything will spill, go to pieces.

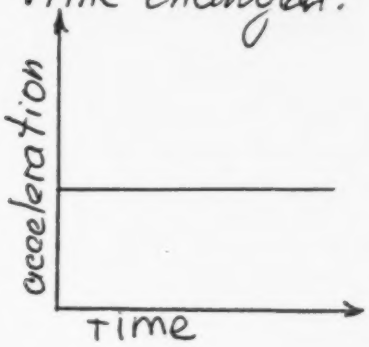
4. We have been using graphs to help us understand relationships. One example is the graphs of distance, velocity and acceleration for objects in free fall. ....



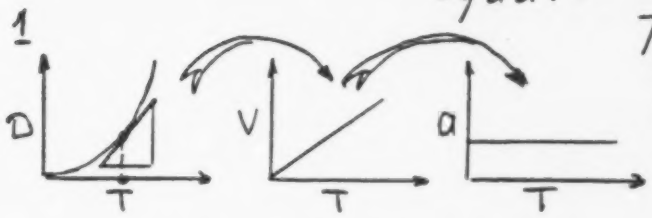
This graph is velocity vs time. The slope of this line, wich looks like line, represent acceleration. Acceleration doesn't changing. Acceleration is equal changing velocity in 1 time interval

devided by changing in time

This graph is distance vs time. The slope of this line reppresent velocity because the object, which movement is showing here, in time interval descovered on distance, and in the same interval but a little later it descovered much more distance. This graph looks like parabola and we can say that parabola means chanving, I mean, what slope represent is not constant. Speed every time changed.



This graph is ~~dist~~ acceleration vs time. This graph sais that acceleration is constant. In free fall acceleration constant. In any time interval ~~velocity~~ the chanving ~~with~~ in velocity was equal.



They are conneeted to each other two different ~~way~~. First is shown in figure number 1.

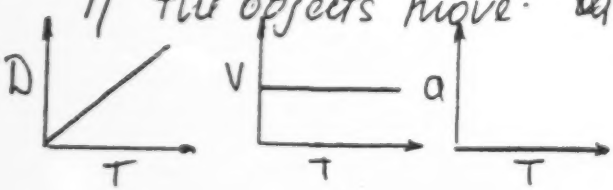
Let's take the graph distance vs time. Take one point in the parabola's line and find

the slope (m) in this point. How we already know that this slope represent velocity it means that in that time (x-intercept) it was m-velocity. Now find (x-intercep (which equal time in that moment) in the grap velocity vs time. $T_D = T_v$. Look at point which represent this time in the line and then find y-intercept. This number it will be closer to slope in point (distance vs time. The same situation with connection velocity graph and acceleration graph.

They connected also a back direction. if you now acceleration and time interval you can find velocity, and if you now ~~change~~ velocity in time you can find distance and of eairse ~~you~~ using these graphs.

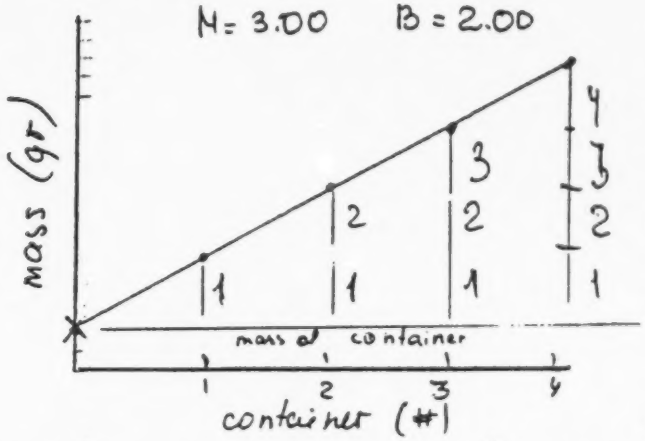
In general I'll try to give the determining about what does the slope tell us.? The slope is ratio of one axis which number is changing of this axis to correspoding to it in another axis.

If the objects move at constant velocity the graphs look like I show.



77

5. In several of the math activities we have drawn graphs and expressed the relation_ship in algebraic equation (the Mystery Container, Temperatures) Draw a graph with a linear relationship between two variables. Write the equation for it. What does y-intercept and the slope represent (for your variables)?



From these two activities I did Mystery Container. It's real interesting work. Here I draw graph with linear relationship between total mass of container and number of container. This is not exactly what we had, this point was took very simple to make how it must be. We can suppos that there are kind of coin in container which increase in mass from container to container represent. This slop represent mass changing mass of container. How I said already that some coin increase we can say that the slop represent mass of coin. The slope is the line and we can say that increase in container is constant X - it is their y-intercept in the graph, what represent mass of emply con-

tainer. The equation for it

$$M_{Total} = M_{coin} \times N_{coin} + M_{cont.}$$
$$M_T = 3 \times N_{coin} + 2$$

Another way.
We have total mass of each container.

$M_{Total}\ \#1 = a$	$a - m_{coin} = m_a$
$M_T\ \#2 = b$	$b - m_c = m_b$
$M_T\ \#3 = c$	$c - m_c = m_c$
$M_T\ \#4 = d$	$d - m_c = m_d$
... = ...	... = ...
$M_T\ \#N = N$	$N - m_c = m_N$

$m_a, m_b \ldots m_N$ ~~mass~~ without = mass of empty container

We don't know what kind of coin is inside ~~coins~~ maybe two different together. We measure different coins like panny, dime etc. Than we have to try all combination which is possible, what can be inside each container, and what numbe'll be closest we can defin. what is inside.
In our situation we recieved panny.

6. Do you think your work in project adventure changed the way you worked in class? Did you find out anithing suprising about yourself?

I like project adventure and I think that this subject make our „motion" life more interesting. When you set in literature, in math and in physics you have to be concentration, almost every time you have to think, write, read. And when you go to gym it it make your life more fun, more interesting and it make us more doing something in other subjects. But don't think please that in literature, math and physics I feel terrible and only project adventure make me feel fun, happy. Everything what I saed means that my opinion in this question is positive. I realy think that my work in project adventure changed the way I worked in class. What I can say about surprising in myself, that I started to observe something interesting in myself. When we did some activity for example climbing and when we were in net, before I felt what I had to do to be more accurately and later it was like I felt. I think it is very important because sometimes the people don't have this feelings. I think that is intuition It's important because it means almost like can to see, hear etc.

Exhibit E

Evaluation Guidelines

Reader's Name:_____

The following categories and descriptions were generated by the Motion class to be used in self, peer, and instructors' evaluations. For a person to deserve an A in classwork or portfolio, they should be an A in most of the categories, not necessarily every one. For a person to deserve a B, they should be a B in most of the categories. They may be an A in some and C in some.

Classwork:

Attendance, lateness

A None except for emergencies
B 2-3
C 4-6
D 7-8
N.C. 9 or more

Mark_____

Working with others

Leader, supports others, helps others
A almost all of the time
B most of the time
C sometimes yes, sometimes no
D rarely, needs improvement
N.C. not acceptable

Mark_____

The amount of work completed

Has completed _____ activities.
A 14-15 activities
B 12-13 activities
C 10-11 activities
D 8-9 activities
N.C. not acceptable

Mark_____

Concentration

Works on activities, does not fool around
A almost all of the time
B most of the time
C sometimes yes, sometimes no
D rarely, needs improvement
N.C. not acceptable

Mark_____

Understanding of classwork

Can explain almost all of the work to others
A almost all of the time
B most of the time
C sometimes yes, sometimes no
D rarely, needs improvement
N.C. not acceptable

Mark_____

Communication growth

Progress in the ability to write, speak, and understand English, or consistent mastery
A excellent
B good
C fair
D poor
N.C. not acceptable

Mark_____

Classwork Mark: _____

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